

PICKUP TRUCK TEST PM RANKS NEW F-150, RAM & MORE

Popular Mechanics

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Science Technology Automotive Home Outdoors

WHO'S TRACKING YOU?

DIGITAL SNOOPS CAN:

HIJACK YOUR WEBCAM

PINPOINT YOUR CELLPHONE

READ YOUR E-MAIL

FOLLOW YOUR MOVEMENTS

How You Can Fight Back

PUT YOUR HOUSE ON REMOTE CONTROL

BUILD A CLASSIC TOOLBOX

5 FUN PROJECTS FOR THE NEW YEAR

BOOST YOUR WI-FI RANGE



10 BEST HI-DEF MOVIES

MAKE THEM LOOK GREAT ON YOUR HOME SYSTEM

CAN YOU TRUST YOUR CAR MECHANIC?

HOW TO DECODE A REPAIR ORDER



ALL-NEW '09 F-150

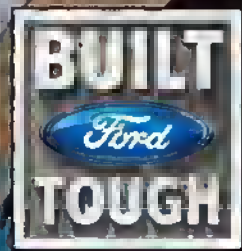
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Heavy Lifters

PM tests the new Ford F-150 and Dodge Ram 500 against the crew-cab competition—hauling, fuel economy and more.

BY LARRY WEBSTER

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ON THE COVER PM's digital imaging specialist, Anthony Verducci, added a snarl of cable, faux branding and a sinister red glow to the lens of a webcam. *Photograph by Burcu Avsar*

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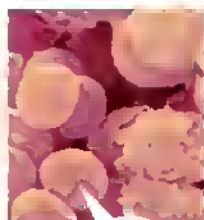
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WHAT THEY'RE DOING

DANIEL H. WILSON

Robotist, author of *Where's My Jetpack?*

Wilson put his book of science personality profiles, *Mad Scientist Hall of Fame*, on shelves in September after skydiving and forging samurai swords as host and stuntman of the History Channel series *The Works* in the first half of 2008. Wilson is now in concept development with DreamWorks Animation on a future project—no details have been made public.



NOW, MORE MPG WITH THE WORLD'S FIRST ECO-FRIENDLY SPARK PLUG



Actually, it's called a pulse plug—here's why its technology should be in your engine.

Until now, every gallon of gas you bought was ignited by a simple spark plug—an outmoded technology that has barely changed in 100 years. But now you can change to a new eco-friendly pulse plug that uses an advanced technology to make every drop of gas burn better and cleaner.

This new technology—with its eight patents—is based on plasma research supported by the world famous Sandia National Laboratories—and yes, that's *definitely* rocket science.



See the difference in technology: compare the cross section of a typical spark plug above, with that of the new pulse plug below.



Here's how it works: electrical energy from the engine's power coil is stored in the pulse plug's built-in capacitor. At the exact moment needed, that energy is released in an amazingly quick (two nanosecond), powerful, high-energy pulse.

The result: the improved combustion efficiency burns fuel sooner and more effectively, which means better fuel mileage, less CO₂ based emissions, and better overall drivability. For example, here is the result of a recent, highly-controlled fuel consumption lab test:

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CES NEWS Tomorrow's hottest gadgets are unveiled at the Consumer Electronics Show Jan. 8–11 in Las Vegas. PM's there to report on the best new products, from the next Google phone to the thinnest flat-screen TVs.

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Best Drives Visit us for more car reviews and get our take early on rides like the 2009 Saturn Vue two-mode Hybrid (right). When the Detroit show rolls around Jan. 17–25, we'll be there too, with comprehensive coverage of next year's best cars.



New Ride Specs /// Insider Comparisons
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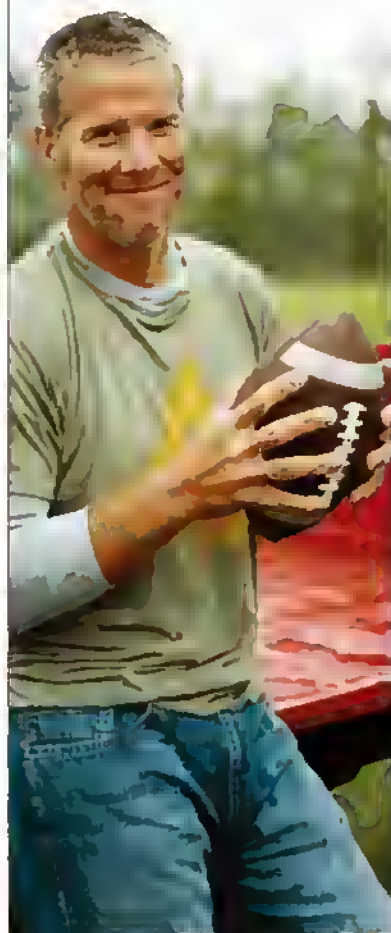
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Innovative Thinking

Thanks for featuring the work of the Caltech students and Intelligent Mobility International founders in the November "Breakthrough Awards" story. I love the idea of converting old bicycles into wheelchairs for the disabled in developing countries. These students deserve recognition for their initiative. The work of improving the lives of those who are often ignored or forgotten is very important.

MICHAEL VON CAPPELN
SAMMAMISH, WA

I just read the story about Greg Allgood and Procter & Gamble's PUR water purification powder with great interest. I'll be purchasing some to have on hand in case of emergencies.

NANCY HENDRYX
BOW, NH

ISSUE
11/08

Readers responded to the innovations featured in PM's Breakthrough Awards issue and to tips for saving energy.

I enjoyed reading your list of gadgets in "Brilliant Design, Ready Now." Each product piqued my curiosity until I came to the last one: the Caroma toilet with a sink above the tank to catch gray water for reuse. These toilets sit in just about every Japanese household, including my own apartment. Innovative? Yes, but from a decade ago.

ANDREW WOLFF
IWAKUNI, JAPAN

EDITOR'S RESPONSE: The PM team tests and evaluates hundreds of products each year to compile our list of the 10 best. We are biased,

however, toward products available in the United States. We're thrilled gray-water reuse toilets are a success in Japan and hope for the same proliferation in the U.S.

Energy Savers

Great suggestion, in your story "19 Ways to Slash Your Utility Bill," about using CFLs to save energy, but you need to do more shopping around for the bulbs. Recently I bought a 10-pack that cost just \$1.30 a bulb for the 60-watt equivalent.

AVRAM ADELMAN
RALEIGH, NC

The only problem with using power strips to completely power down your television and DVR/DVD equipment is that many devices lose their programming without any electricity. Until engineers fix that problem, the power drain continues.

PHIL TKACHUK
EDMONTON, ALBERTA

EDITOR'S RESPONSE: Products such as the Belkin Conserve surge protector and power strip are designed to address this exact problem. The strip has two plugs that continuously supply power to devices and six that can be turned off. The best feature? A remote that allows you to kill the power without fussing with the strip.

what do you think?

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CHRIS GRUNDY,
TOOL EXPERT AND HOST
OF COOL TOOLS
DIY Network

A PUBLIC SERVICE MESSAGE
from **POPULAR MECHANICS**



TECHWATCH

Mystery Machine

A GRAVITY-SENSING SATELLITE SEEKS TO ANSWER LINGERING PLANETARY QUESTIONS.

BY JOE PAPPALARDO

Gravity is not the same everywhere on Earth. It is influenced by geological formations and the varying density of materials beneath the planet's surface. To map these gravitational differences, the European Space Agency has built GOCE (Gravity field and steady-state Ocean Circulation Explorer), to be launched in early 2009. (The 16.5-ft craft is shown here in a test chamber that approximates the working conditions it will encounter in orbit.) To pick up the subtle differences in gravity, the satellite will circle about 155 miles above the planet, far lower than most spacecraft. GOCE has three pairs of ultrasensitive accelerometers that respond to tiny variations in the gravitational tug of the Earth. But it has no moving parts—engineers say this will allow for the most accurate data collection.

Questions for GOCE

What's under the Earth's crust?

GOCE can identify subtle differences in materials to a depth of about 124 miles, valuable for studying tectonic plate movements and

developing earthquake advance-warning systems.

How tall are mountains really?

Countries don't all agree on how to measure sea level

(recent calculations of Mount Everest's peak differ by more than 16 ft). A common international reference point will enable mega-engineering projects such as

longer pipelines and subsea tunnels.

How will Earth react to melting ice sheets?

GOCE data will unify disparate tide

gauge records, so that sea levels can be compared globally. It will also provide detailed data on the speed and direction of ocean currents.

A MECHANICAL MARTIAN INSECT

✦ Dutch scientists have built a prototype robot dragonfly that could provide aerial reconnaissance for future Mars rover missions. The ExoFly's Mylar wings, balsa frame, onboard camera and lithium-polymer battery have a total mass of less than an ounce. An earthbound prototype flaps its wings six times per second, but a Martian version would have to flap faster to stay aloft in the thinner atmosphere. ExoFly would guide rovers and take samples of various airborne chemicals.

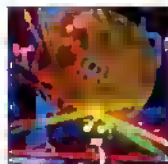
New Asteroid Alarm Is a Hit

If the end is coming, earthlings will at least get some warning. That's the good news after astronomers for the first time spotted a space rock headed in our direction before it actually hit. About 19 hours elapsed between the discovery of 2008 TC₃ (by the Arizona-based Catalina Sky Survey) and its final, fiery explosion. The asteroid met its end over the Sudan, harmlessly releasing the equivalent of 1000 tons of TNT as soon as it hit the atmosphere. Images from 26 observatories across the globe allowed astronomers to precisely predict impacts. The next (big) step: Figuring out how to stop inbound meteors from hitting Earth.



AVOIDING THE FATE OF THE EIGHT-TRACK

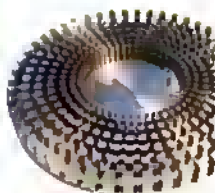
✦ Holographic discs may be the next breakthrough for storing information. Instead of being etched with patterns only on the surface, a holo-disc saves data throughout its interior. When the first holographic discs reach the market later this year, users will need to buy expensive systems to handle the 300 GB discs. But scientists at GE Global Research are working on a laser system that can read CD, DVD and holographic discs; the system may reach the market by 2012.



NEWSBRIEFS

Reports From the Edge of Science

Compiled by Alex Hutchinson



Engineering a Way to Make Wave Damage Disappear

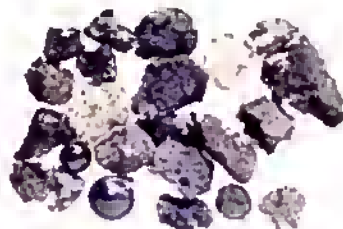
✦ Researchers in France and Britain have proposed the first practical use for recently developed "invisibility cloaks" that, ideally, would guide light around objects to make them disappear. Instead of lightwaves, researchers propose guiding water around offshore oil platforms to protect them from damaging waves and tsunamis. A series of pillars arranged in a concentric ring pattern (shown left, in a 4-in. prototype) would guide the waves into a whirlpool pattern around the structure, with the water emerging on another side as if no barrier existed.

SMART CARS TO END GRIDLOCK

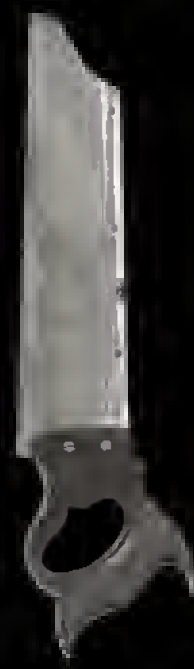
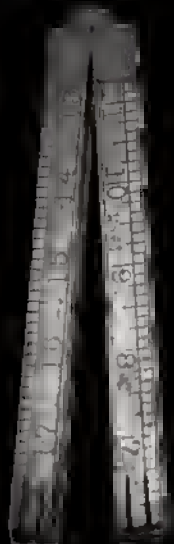
✦ If cars could talk to each other, it would be easy for drivers to avoid traffic jams. MIT scientists have been running a pilot project in Boston since early 2008 that enables speeding cars to connect with roadside Wi-Fi locations in just 360 milliseconds, rather than the typical 15 seconds. In that brief time, cars upload their position and speed. The 50-car project already has one beneficiary: The professor heading it shortened his own commute by 25 percent.

Moon Dust: Peril and Promise

✦ When astronauts walked on the moon, fine but abrasive lunar dust (below, in microscopic detail) infested the lander. Scientists recently presented a new concept for the next manned moon mission: air filters using magnets that attract the specks of iron in each dust particle. Microwaves could then melt collected dust into a smooth surface to create moon roads, lunar landing pads or insulation against space radiation.

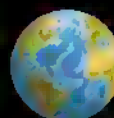


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➔ Submarine rescue stands out as a model of military cooperation. American, Russian, Greek, Ukrainian, Turkish and other naval operators of new rescue equipment proved it last fall when they gathered off the coast of Norway to show how their hardware could work with other nations' submarines.

The U.S. Navy demonstrated a tethered, remotely operated minisub called the Rescue Capable System, which mated with submarines from Norway, the Netherlands and Poland during the exercise. The RCS can fit in cargo aircraft and be launched from a variety of military or commercial vessels, enabling it to reach a stricken submarine anywhere on the globe within 72 hours.

The craft is the second of three elements in the Navy's rescue arsenal. The first, a suit delivered in 2006, lowers a diver to a sub to clear debris from hatches. A decompression system expected in 2012 will enable submariners rescued under pressure to remain that way during the transfer from the RCS to shipboard hyperbaric treatment chambers.

Robbing Davy Jones

NAVIES AROUND THE WORLD ARE DEVELOPING NEW GEAR TO SAVE SUBMARINE CREWS TRAPPED AT THE BOTTOM OF THE OCEAN. BY JOE PAPPALARDO

The U.S. Navy recently demonstrated its newest deep-sea rescue gear: a dive suit and a remote-control sub.



+ **THE WORLD LEARNED A GRIM LESSON** about the complexities of deep-sea rescue in August 2000, when the Russian nuclear submarine *Kursk* sank during an exercise. Other subs reached the vessel but could not open the hatches. Russia asked NATO to help, but it was too late; all 118 crew died. The result: New Russian (far left) and NATO (left) rescue subs are designed to get to a disaster scene quickly and to connect to the hatches of foreign submarines.

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Your options may include adding ABILIFY to
the antidepressant you're already taking.**

**ABILIFY is FDA-approved to treat depression in adults when
added to an antidepressant (such as Lexapro®, Zoloft®, Prozac®,
Effexor XR®, Paxil CR®, or a generic equivalent).***

IMPORTANT SAFETY INFORMATION:

Elderly patients with dementia-related psychosis (eg, an inability to perform daily activities due to increased memory loss) taking ABILIFY have an increased risk of death or stroke. ABILIFY is not approved for treating these patients.

Antidepressants can increase suicidal thoughts and behaviors in children, teens, and young adults. Serious mental illnesses are themselves associated with an increase in the risk of suicide. When taking ABILIFY call your doctor right away if you have new or worsening depression symptoms, unusual changes in behavior, or thoughts of suicide. Patients and their caregivers should be especially observant within the first few months of treatment or after a change in dose. Approved only for adults 18 and over with depression.

- Alert your doctor if you develop very high fever, rigid muscles, shaking, confusion, sweating, or increased heart rate and blood pressure, as these may be signs of a rare but potentially fatal condition called neuroleptic malignant syndrome (NMS)
- If you develop abnormal or uncontrollable facial movements, notify your doctor, as these may be signs of tardive dyskinesia (TD), which could become permanent
- If you have diabetes or have risk factors or symptoms of diabetes, your blood sugar should be monitored. High blood sugar has been reported with ABILIFY and medicines like it. In some cases, extreme high blood sugar can lead to coma or death
- Other risks may include lightheadedness upon standing, seizures, trouble swallowing, or impairment in judgment or motor skills. Until you know how ABILIFY affects you, you should not drive or operate machinery

The common side effects in adults in clinical trials ($\geq 10\%$) include nausea, vomiting, constipation, headache, dizziness, an inner sense of restlessness or need to move (akathisia), anxiety and insomnia. Tell your doctor about all the medicines you're taking, since there are some risks for drug interactions. You should avoid alcohol while taking ABILIFY.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch, or call 1-800-FDA-1088.

Please read the Important Information about ABILIFY on the adjacent page.

*Lexapro® (escitalopram oxalate), Zoloft® (sertraline HCl), Prozac® (fluoxetine hydrochloride), Effexor XR® (venlafaxine HCl), Paxil CR® (paroxetine HCl) are trademarks of their respective companies.

**ADD-ON TREATMENT FOR
UNRESOLVED SYMPTOMS
OF DEPRESSION IN ADULTS**


ABILIFY®
(aripiprazole)

2 mg, 5 mg Tablet

www.abilify.com

If you or someone you know needs help paying for medicine, call
1-855-4PPA-NOW (1-855-477-2669). Or go to www.pparx.org



Partnership for
Prescription Assistance





IMPORTANT INFORMATION ABOUT ABILIFY

This summary of the Package Insert contains risk and safety information for patients about ABILIFY. This summary does not include all information about ABILIFY and does not take the place of discussions with your healthcare professional about your treatment. Please read this important information before you start taking ABILIFY and discuss any questions about ABILIFY with your healthcare professional.

Name

ABILIFY® (a-BIL-i-fi) (aripiprazole) (a-i-PiP-ra-zol)

What is ABILIFY?

ABILIFY (aripiprazole) is a prescription medicine used as an add-on treatment to antidepressants for Major Depressive Disorder in adults.

What is depression?

Depression is a common but serious medical condition. Symptoms may include sadness, loss of interest in activities you once enjoyed, loss of energy, difficulty concentrating or making decisions, feelings of worthlessness or excessive guilt, insomnia or excessive sleep, a change in appetite causing weight loss or gain, or thoughts of death or suicide. These could be depression symptoms if they interfere with daily life at home, at work, or with friends and last most of the day, nearly every day for at least 2 weeks.

What is the most important information that I should know about antidepressant medicines, depression, and other serious mental illnesses?

- Antidepressant medicines may increase suicidal thoughts or actions in some children, teenagers, and young adults
- Depression and serious mental illnesses are the most important causes of suicidal thoughts and actions

For more information, see the Prescribing Information and the Medication Guide called *Antidepressant Medicines, Depression and Other Serious Mental Illnesses, and Suicidal Thoughts or Actions*.

Who should NOT take ABILIFY?

People who are allergic to ABILIFY or to any substance that is in it. Allergic reactions have ranged from rash, hives and itching to difficulty breathing and swelling of the face, lips, or tongue. Please talk with your healthcare professional.

What is the most important information that I should know about ABILIFY?

Elderly patients, diagnosed with psychosis as a result of dementia (for example, an inability to perform daily activities as a result of increased memory loss), and who are treated with antipsychotic medicines including ABILIFY, are at an increased risk of death when compared to patients who are treated with a placebo (sugar pill). ABILIFY is not approved for the treatment of patients with dementia-related psychosis.

Antidepressants may increase suicidal thoughts or behaviors in some children, teenagers, and young adults, especially within the first few months of treatment or when the dose is changed. Depression and other serious mental illnesses are themselves associated with an increase in the risk of suicide. Patients on antidepressants and their families or caregivers should watch for new or worsening depression symptoms, unusual changes in behavior, or thoughts of suicide. Such symptoms should be reported to the patient's healthcare professional right away, especially if they are severe or occur suddenly. ABILIFY is not approved for use in pediatric patients with depression.

Serious side effects can occur with any antipsychotic medicine, including ABILIFY. Tell your healthcare professional right away if you have any conditions or side effects, including the following:

Stroke or ministroke in elderly patients with dementia: An increased risk of stroke and ministroke has been reported in clinical studies of elderly patients with dementia (for example, increased memory loss and inability to perform daily activities). ABILIFY is not approved for treating patients with dementia.

Neuroleptic malignant syndrome (NMS): Very high fever, rigid muscles, shaking, confusion, sweating, or increased heart rate and blood pressure may be signs of NMS, a rare but serious side effect that could be fatal.

Tardive dyskinesia (TD): Abnormal or uncontrollable movements of face, tongue, or other parts of body may be signs of a serious condition known as TD, which may be permanent.

High blood sugar and diabetes: Patients with diabetes and those having risk factors for diabetes (for example, obesity, family history of diabetes), as well as those with symptoms such as unexpected increases in thirst, urination, or hunger should have their blood sugar levels checked before and during treatment. Increases in blood sugar levels (hyperglycemia), in some cases serious and associated with coma or death, have been reported in patients taking ABILIFY, and medicines like it.

Orthostatic hypotension: Lightheadedness or faintness caused by a sudden change in heart rate and blood pressure when rising too quickly from a sitting or lying position (orthostatic hypotension) has been reported with ABILIFY.

Suicidal thoughts: If you have suicidal thoughts, you should tell your healthcare professional right away.

Dysphagia: Medicines like ABILIFY (aripiprazole) have been associated with swallowing problems (dysphagia). If you had or have swallowing problems, you should tell your healthcare professional.

What should I talk to my healthcare provider about?

Patients and their families or caregivers should watch for new or worsening depression symptoms, unusual changes in behavior and thoughts of suicide, as well as for anxiety, agitation, panic attacks, difficulty sleeping, irritability, hostility, aggressiveness, impulsivity, restlessness, or extreme hyperactivity. Call your healthcare provider right away if you have thoughts of suicide or if any of these symptoms are severe or occur suddenly. Be especially observant within the first few months of antidepressant treatment or whenever there is a change in dose.

Tell your healthcare provider about any medical conditions you may have and all medicines that you are taking or plan to take, including prescription and nonprescription (over-the-counter) medicines.

Be sure to tell your healthcare provider:

- If you have suicidal thoughts
- If you or anyone in your family have or had seizures
- If you or anyone in your family have or had high blood sugar or diabetes
- If you are pregnant, plan to become pregnant, or are breast-feeding

What should I avoid when taking ABILIFY?

- Avoid overheating and dehydration
- Avoid driving or operating hazardous machinery until you know how ABILIFY affects you
- Avoid drinking alcohol
- Avoid breast-feeding an infant

What are the possible side effects of ABILIFY?

Common side effects in adults include: nausea, vomiting, constipation, headache, dizziness, an inner sense of restlessness or need to move (akathisia), anxiety and insomnia.

It is important to contact your healthcare professional if you experience prolonged, abnormal muscle spasm or contraction which may be signs of a condition called dystonia.

What percentage of people stopped taking ABILIFY due to side effects?

In clinical trials, the percentage of adults who discontinued taking ABILIFY due to side effects was ABILIFY (6%) and for patients treated with sugar pill (2%).

Can I safely take ABILIFY while I'm taking other medications?

ABILIFY can be taken with most drugs; however, taking ABILIFY with some medicines may require your healthcare professional to adjust the dosage of ABILIFY.

Some medicines include:

- ketoconazole (NIZORAL®)
- quinidine (QUINIDEX®)
- fluoxetine (PROZAC®)
- paroxetine (PAXIL®)
- carbamazepine (TEGRETOL®)

It is important to tell your healthcare professional about all the medicines you're taking, just to be sure.

General advice about ABILIFY:

- ABILIFY is usually taken once a day, with or without food
- ABILIFY should be kept out of the reach of children and pets
- Store ABILIFY Tablets and the Oral Solution at room temperature
- For patients who must limit their sugar intake, be aware that ABILIFY Oral Solution contains sugar
- For patients who cannot metabolize phenylalanine (those with phenylketonuria or PKU), ABILIFY DISCMLT® contains phenylalanine
- If you have additional questions, talk to your healthcare professional

Find out more about ABILIFY:

Additional information can be found at www.abilify.com

* NIZORAL is a registered trademark of Janssen Pharmaceutica, QUINIDEX is a registered trademark of Wyeth Pharmaceuticals, PROZAC is a registered trademark of Eli Lilly and Company, PAXIL is a registered trademark of GlaxoSmithKline, TEGRETOL is a registered trademark of Novartis Pharmaceuticals.

Based on Full Prescribing Information as of 05/08 1239550A2.



Otsuka Otsuka America Pharmaceutical, Inc.

Tablets manufactured by Otsuka Pharmaceutical Co., Ltd., Tokyo, 101-8535 Japan or Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
Orally Disintegrating Tablets, Oral Solution, and Injection manufactured by Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
Distributed and marketed by Otsuka America Pharmaceutical, Inc., Rockville, MD 20850 USA.
Marketed by Bristol-Myers Squibb Company, Princeton, NJ 08543 USA.
U.S. Patent Nos. 5,006,928; 6,977,257; and 7,115,587.

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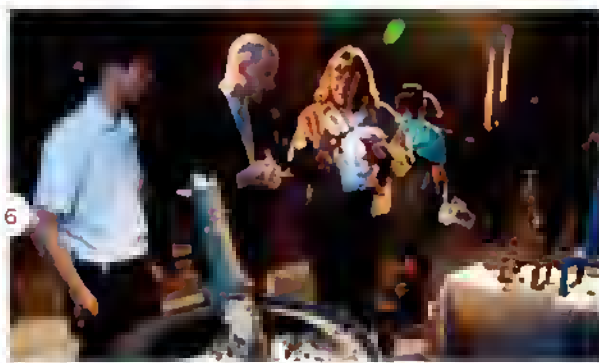
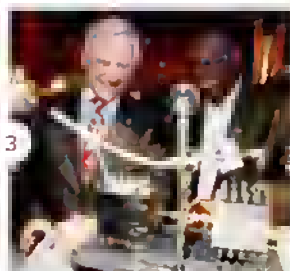
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May 2008

Brilliant Breakthrough Innovators Join Forces at PM



→ Rocket scientists, inventors and game designers met at the 2008 POPULAR MECHANICS Breakthrough Awards, sponsored by Bristol-Myers Squibb, on Oct. 15. *Apollo 11* astronaut and PM adviser Buzz Aldrin, *DIY Cool Tools* host and PM contributor Chris Grundy and other friends joined us at PM's home, Hearst Tower in New York City, to salute the winners. See more at popularmechanics.com/breakthrough08.



❶ Editor-in-chief **Jim Meigs** described PM's role as a forum for ideas in science and technology.

❷ Children's Safe Drinking Water director **Greg Allgood** (left) showed off PUR water tech to the National Science

Foundation's **Joshua Chamot**. ❸ **Buzz Aldrin** (left) talked with **Lonnie Johnson** about Johnson's JTEC,

which uses heat to generate electricity. (The inventor is best known for his Super Soaker water gun.) ❹ Aterra CEO **Steve Fambro** (left), **Aldrin**, PM auto editor **Ben Stewart** and executive editor **David Dunbar** kicked the tires—all three of them—on Fambro's electric car. ❺ **Will Wright** (left), who created *Spore*, *The Sims* and other games, toured the Stage motion-capture system with its inventor, **Andrew Tschesnok**.

❻ 2007 Breakthrough honoree **Shawn Frayne** (left) and PM home editor **Roy Berendsohn** talked with MIT's **Amy Smith**, Frayne's former instructor and PM's 2008 Leadership Award winner.

Straight Talk

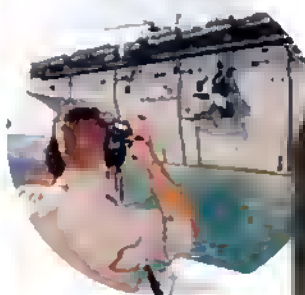
ENHANCED BINOCULARS GIVE USERS MORE THAN A CLOSE VIEW BY TRANSMITTING UNTAPPABLE VOICE AND VIDEO SIGNALS.

BY ERIN MCCARTHY

→ It seems the stuff of James Bond—a pair of spies on opposite rooftops exchanging information via binoculars. However, it's real. The U.S. military is currently using binoculars equipped with USB and Ethernet adapters and receivers that are capable of beaming secure voice and video information. The LightSpeed system exploits free-space optics—the ability to pass data between two points via an optical beam. The method usually involves lasers, but this system uses eye-safe infrared LEDs, similar to those used in TV remotes, says Leo Volfson, president of Torrey Pine's Logic, which created LightSpeed. "The binocular has an attachment that fits over the ocular side," Volfson says. "It produces a beam

that comes out of the right eye of the binocular. On the left side is a receiver. If you look at me and I look at you, we'll be able to talk or send information." Range is determined by the strength of the optics. Unlike radio-wave transmissions, data transfer through the LED beam is undetectable.

Volfson says hundreds of binoculars have been bought, mostly by U.S. and foreign special operations units, but he doesn't think his customers are limited to the defense industry. Volfson envisions uses at airports (where conflicting signals from planes interfere with ground-based radio), in eavesdropping devices or in "any environment where you don't want to have a cable."



Beams of light carry secure voice messages between Navy vessels.



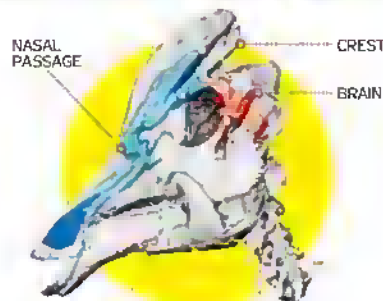
→ SPECS

- **Data Com**
Up to 1 million bits per second
- **Voice Com**
32 kilobits per second (simultaneous with data)
- **Weight**
1.3 pounds
- **Upper Range**
1.8 miles
- **Power**
2 watts

HEAD CASES

CT scans of dinosaur skulls hint at deeper dino communication.

Researchers have long speculated on the purpose of the distinctive, bony protrusions found on the heads of duck-billed dinosaurs (which were discovered in the 1910s), theorizing that they were used by the cold-blooded creatures to gather heat, breathe while swimming or enhance their sense of smell. Now, after undertaking computed axial tomography scans of the beasts' heads, researchers in Canada and the U.S. have proclaimed that the crests developed to enhance communication. Paleontologists at the Royal Ontario Museum and the University of Toronto obtained detailed pictures of structures inside the skulls for four species of lambeosaur, a duck-billed herbivore. The heads of the dinosaurs contained a delicate inner ear that enabled them to hear low-frequency calls. The shape of the nasal passages in the crest apparently produced a low bellow that such an ear could easily detect. —J.P.



Interplanetary Iditarod

HARDY EARTHLINGS WILL HITCH A THREE-YEAR RIDE ABOARD A MARS-BOUND SPACECRAFT TO DETERMINE IF LIFE CAN SPREAD BETWEEN PLANETS. BY MICHAEL MILSTEIN

When a Russian spacecraft sets off late this year to scrape samples of the Martian moon Phobos, at least 10 of Earth's toughest life-forms will be going along for the ride. The pioneering experiment, sponsored by the nonprofit Planetary Society, will test whether life can tolerate the deadly hazards of space for three years—long enough to hopscotch between planets. Three of each of the 10 chosen organisms will ride inside individual polymer containers. The quarter-pound biomodule that houses the organisms approximates the conditions they would encounter traveling on a space rock that has been knocked off a planet by a meteor. Many of the passengers have their own built-in protections, such as hard seed coats and the spores that bacteria form in response to hostile environments.

The biomodule's titanium housing partially shields its passengers from radiation—the same protection they would have if travelling on a meteor—but it is designed to cushion them during the return to Earth in 2012. When the spacecraft returns, it will drop the module that holds the organisms and the Phobos samples into the atmosphere without parachutes. Scientists are relying on air resistance and a layer of crushable material in the base of the capsule to help absorb the impact. Life on Earth has been found in unlikely places—boiling hot springs, nuclear reactors and thermal vents at the bottom of the ocean—so scientists are hopeful that the samples will survive the trip.

The Russian Federal Space Agency has been working on a mission to retrieve soil samples from the Martian moon of Phobos since 2005. The craft is expected to launch late this year.



Notable Passengers

Hypsibius dujardini

A radiation- and temperature-resistant creature better known as the water bear. The 1 mm animal suspends all biological activity when exposed to extreme environments, reactivating when conditions are better.

Deinacoccus radiodurans

Listed in the Guinness Book of World Records as the "world's toughest bacterium." It can survive exposure to radiation, frigid cold, drought and acid. Researchers discovered it when they radiated food to kill bacteria—and this one survived.

Arabidopsis thaliana

A small flowering plant native to Europe, Asia and northwestern Africa. Its genome was the first of the plant world to be sequenced. Seeds that rode Apollo 16 and Apollo 17 later germinated on Earth.



ON THE WEB > Find five new research projects to see if life on Earth came from comets, at popularmechanics.com/futurespace.

Seeing the Forest Fires Through the Trees

GREEN ENERGY TAKES ON NEW MEANING WITH WILDFIRE SENSORS POWERED BY THE WOODY PLANTS THEMSELVES. BY ALEX HUTCHINSON

→ Voltree Power's big idea started as a rumor on the Internet: If you drive a nail into a tree trunk and another piece of metal into the ground nearby, the claim goes, you can measure a voltage difference between the two. It turned out to be true. Now the startup company is racing to complete prototypes of miniature tree-powered forest-fire sensors in time for this spring, when it will field-test its detection gear during a controlled burn set by the U.S. Forest Service.

It's been quite a journey for a project that started in 2006 when a small Massachusetts engineering firm called MagCap (whose officers now helm Voltree) put up \$10,000 to hire a Massachusetts Institute of Technology chemistry freshman to figure out whether trees really produce electricity. It turned out that a slight difference of acidity between tree and soil creates an imbalance of hydrogen ions, generating voltage. The next question was: What could be done with such limited power?

The MIT researchers devised a sensor that could measure temperature and humidity and store enough energy to broadcast data four times a day. Since the power source is limited, the range of the signals is low. But a mesh network of sensors could bounce a signal from tree to wired tree until it reaches one of the 2200 automated weather stations scattered through the country. These, in turn, would beam the data via satellite back to the National Interagency Fire Center in Idaho.

[4] Fire service monitoring stations receive the alert and can tell the speed and strength of a forest fire.

[3] Information is sent to a satellite via existing unmanned weather stations.

[2] The temperature and humidity sensor serves as a fire alarm.

[1] A bioenergy battery charger draws on the electricity generated by the tree.



Time
Machine
DECEMBER
1969

⌚ Nearly 40 years ago, drivers in Texas faced a new law-enforcement technology: an automatic camera. In December 1969 PM examined Orbis, an early antispeeding device, which took pictures of both license plates and drivers' faces. (The camera "pierces windshield reflections and tints," PM reported.) The drivers then received tickets by mail.

The system generated more tickets than clerks could handle—or did, until drivers started shooting the roadside gear to pieces. Many Americans, even Texans, seem more tolerant of surveillance these days, but the threats to privacy are rising (see "Who's Tracking You?," page 66).



FUEL EFFICIENCY



BIOFUELS



HYBRID



ELECTRIC



FUEL CELL

Gas-friendly to gas-free.

The environment and your commute. Can't we all just get along? Making a difference in our environment is as simple as driving a more fuel-efficient vehicle. That's why Chevy™ offers more models than Toyota or Honda with an EPA estimated 30 MPG highway or better. The 2008 North American Car of the Year, Chevy Malibu® has the best highway fuel economy of any midsize sedan.¹ And then there's the sporty Cobalt® XFE with an EPA estimated 37 MPG highway. That's better highway fuel economy than Toyota Corolla and Honda Civic.² But Chevy has plenty of other ways into the 30 MPG highway or better club, including select models of Malibu Hybrid, HHR®, and the newly redesigned Aveo³ with an EPA estimated 34 MPG highway. And our commitment to fuel economy goes way beyond cars. In fact, there's now a more stylish approach to carrying people and cargo – the all new Chevy Traverse™ offers an EPA estimated 24 MPG highway – the best fuel economy of any eight-passenger crossover.³ It's just one more choice in an already impressive lineup of fuel-efficient vehicles from Chevy. Find out more at chevy.com

AN AMERICAN REVOLUTION




¹ 2008 North American Car of the Year. EPA est. 33 city/41 hwy. (2.4L 4-cylinder, 160-hp, 5-speed manual transmission). Excludes other GM vehicles. ² EPA est. 37 city/41 hwy. (1.8L 4-cylinder, 141-hp, 5-speed manual transmission). Excludes other GM vehicles. ³ Based on 2008 GM Mid-Utility Crossover segment and Traverse FWD with EPA est. 24 city/34 hwy. Excludes other GM vehicles.

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OFFICIAL HDTV OF THE NFL



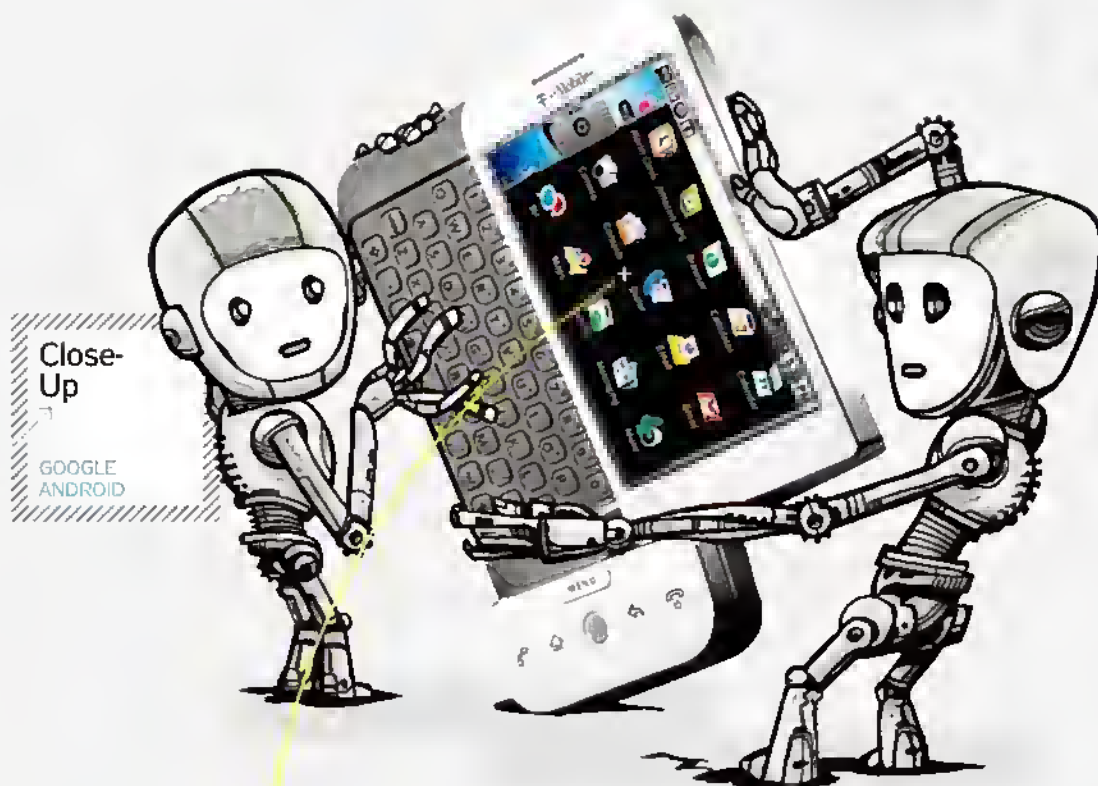
GEAR + TOOLS TOYS

UPGRADE

Safety Drill

Drilling holes extra deep and extra wide—say, for running conduit or plumbing lines through joists—requires something with a bit more power than an average homeowner's drill. But if a powerful tool gets jammed, it can kick back with a vengeance, potentially dislocating a shoulder or knocking you off a ladder. The 11-amp **Dewalt DWD460 ½-in. Stud and Joist Drill** (\$340, dewalt.com) has a sensor that detects when the bit is slowing and gradually cuts the motor's rpm and torque until the drill stops. When the bit is freed up, the drill automatically resumes normal operation. — SETH PORGES

↑
The drill has two modes: powerful and very powerful.



Close-Up

GOOGLE
ANDROID

ON THE WEB > Check out a review of T-Mobile's G1—then learn Android tips and tricks and follow the latest Android news—at popularmechanics.com/android.

After years of hype, Google's Android mobile platform is finally here, making its debut in the **T-Mobile G1 (\$180 w/ contract)**. Android's chief selling point: It is open-source, and less restrictive than the iPhone about what programs developers can release. Our tests found the G1 to be a fine phone—it mixes a sensitive touchscreen with a spacious keyboard, though it's all a bit bulky—but this is just the beginning. For Android to shine, it needs more applications and a sleeker handset to call home. Both will come soon.

Our Favorite Android Applications

CompareEverywhere:

Uses the phone's camera to scan book bar codes and map out nearby stores that carry the title.

Ecorio: Gives users an estimate of their carbon footprint by tracking their travel with the phone's GPS.

Any Cut: Puts a shortcut to any link, application or phone number on the home screen. Our advice: Create one-touch access to GOOG-411 for free directory assistance.

ISkoot for Skype: Out of minutes? This app uses the phone's 3G data connection to make free Skype VoIP calls.

Comparing the Mobile Operating Systems

Android joins a crowded field of mobile platforms. Here's how it compares to the competition.

+ GOOGLE ANDROID



IPHONE OS



WINDOWS MOBILE



BLACKBERRY OS

Usability

Almost as intuitive as the iPhone, though it loses a few points for its lack of multitouch functionality.

Still the gold standard for intuitive mobile interfaces. Anyone can pick it up and be a fluent user in minutes.

Notoriously clunky and frustrating to figure out. Finding simple functions can be tedious.

Its simplicity breeds usability—most operations are simple, straightforward and easy to find.

Applications

Current apps show promise, but it may be a while before developers take full advantage of Android's potential.

Some apps (particularly games) are impressive, but Apple's rules for developers limit the options.

Microsoft makes sure there are lots of programs, including the best mobile version of Office.

A decent library of apps should become more impressive with the new BlackBerry Application Storefront.

Speed/ Responsiveness

A quick and responsive OS. Handles multitasking with greater speed than Windows Mobile.

Extremely responsive, with rare lags when loading programs.

It's far too easy to accidentally load up too many programs at once, which can slow a phone to a halt.

Its bare-bones operation makes for lightning-fast load times.

BOTTOM LINE

Because Android is open-source (meaning anybody can make apps and improve upon its basic source code and functionality), it has the greatest potential for improvement.



What will *you* build?

CG Utility

CG Farmer

CG Padded Palm

CG Super Duty

CG Super Duty

HW Utility

HW Padded Palm

HW Impact Pro

Whatever your next project is, Mechanix Wear Commercial Grade Series and Hardware Series gloves will help you achieve it. Mechanix Gloves. The tool that fits like a glove.®



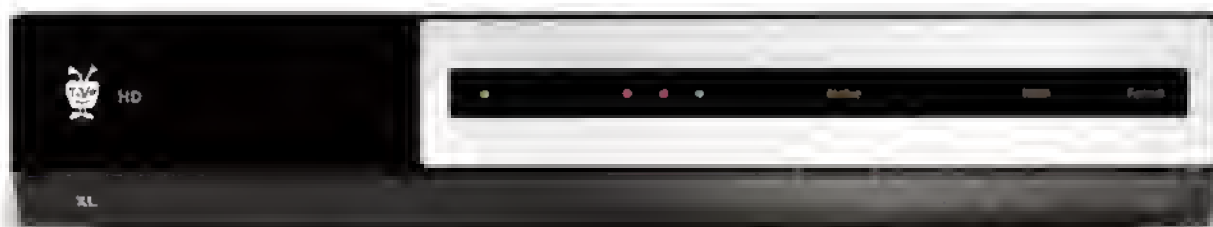
800.222.4296 mechanix.com



Scalable Power

Mobile electronics and their batteries fight a perpetual power war—and battery life takes the hit every time. The updated *Apple MacBook Pro* (from \$2000) doesn't have a game-changing battery, but it does have a clever tactic to compensate. The machine has two graphics cards: The user can switch away from a powerful one intended for heavy computing and graphics-heavy gaming (*Call of Duty* never looked so good on a Mac), to a less-capable one that adds an extra hour of battery life. apple.com

So what can the *TiVo HD XL* (\$600) give you that a DVR rented from a cable company cannot? Tons and tons of storage. One TB to be exact, which translates into 150 hours of high-definition TV or more than 1300 hours of standard TV. That's enough space to ward off arguments over DVR deletions for a long, long time. tivo.com



Two-stroke vehicles are powerful, but they tend to be noisy and stinky, and often have poor fuel efficiency. The two-stroke 600 cc engine in the *Ski-Doo MX Z TNT H.O. E-Tec Snowmobile* (\$9650) uses technology adapted from outboard motors; the manufacturer claims it fixes typical two-stroke drawbacks. On a test drive through the forests of Ontario, we found it to be odorless on startup, as quiet as a four-stroke and as nimble as a dirt bike. ski-doo.com


Test
Drive

SKI-DOO
SNOWMOBILE



Guys, want to take fewer trips to the bathroom at night?

For many men FLOMAX reduces male urinary symptoms due to BPH in 1-WEEK.



Waking up to go?
Stopping and starting?
Going often?
Straining?
Going urgently?
Weak stream?

Talk to your doctor to see if FLOMAX is right for you. FLOMAX could help in one week. FLOMAX is approved to treat male urinary symptoms due to BPH, also called an enlarged prostate. Only your doctor can tell if you have BPH, not a more serious condition like prostate cancer. Avoid driving or hazardous tasks for 12 hours after your first dose or increase in dose, as a sudden drop in blood pressure may occur, rarely resulting in fainting. If considering cataract surgery, tell your eye surgeon you've taken FLOMAX. Common side effects are runny nose, dizziness and decrease in semen. **To learn more, visit 4FLOMAX.com.**

You are encouraged to report negative side effects of prescription drugs to the FDA.

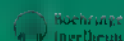
Visit www.fda.gov/medwatch or call 800-FDA-1088.

Please see Important Patient Information on adjacent page.

For many men
FLOMAX[®]
TAMSULOSIN HCl CAPSULES 0.4 MG
The 1-week difference.

If you can't afford FLOMAX, our Patient Assistance Program may help. Call 800-556-8317.

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For a 1-WEEK FREE Trial offer, call 1-877-2-FLOMAX for details.

FLOMAX[®]

TAMSULOSIN HCl CAPSULES 0.4 MG

IMPORTANT PATIENT INFORMATION

What is FLOMAX?

FLOMAX is a prescription medication that is specifically designed to help relieve the signs and symptoms of *benign prostatic hyperplasia (BPH)*, a condition your physician may refer to as an enlarged prostate. FLOMAX works by relaxing the prostate muscles around the urethra, allowing urine to flow more freely out of the bladder. FLOMAX is NOT indicated for the treatment of high blood pressure.

Who should not use FLOMAX?

You should not take FLOMAX if you are allergic to tamsulosin hydrochloride or any other component of FLOMAX.

What should I know while taking FLOMAX?

- o Only your doctor can tell if you have BPH and not a more serious condition, such as prostate cancer. An enlarged prostate (BPH) and cancer of the prostate cause many of the same symptoms. It is important that you see your doctor first to rule out prostate cancer.
- o **FLOMAX may cause a sudden drop in blood pressure, especially following the first dose or when changing doses.** Such a drop in blood pressure, although rare in occurrence, may be associated with fainting, dizziness, or lightheadedness. You should avoid driving or hazardous tasks for 12 hours after the initial dose or after your doctor recommends an increase in dose.
- o During cataract surgery, a condition known as intraoperative floppy iris syndrome (IFIS) has been observed in patients treated with drugs in this class. When considering cataract surgery, inform your surgeon if you are taking or have taken FLOMAX and/or other drugs in this class.
- o Though extremely rare, FLOMAX and other drugs in this class (alpha-1 blockers) have been associated with prolonged painful erection (priapism), which is unrelieved by sex. If this occurs, seek immediate medical attention, since this condition can lead to permanent inability to have an erection, if left untreated.
- o FLOMAX should NOT be used in combination with other drugs in its class since interactions may be expected.
- o FLOMAX should be used with caution in combination with cimetidine or with warfarin (a drug often prescribed under the brand name Coumadin[®] [Bristol-Myers Squibb Company]).

- o If you have had a serious reaction to sulfa, be sure to tell your doctor before taking FLOMAX.

What are the most common side effects of FLOMAX?

The most common side effects are dizziness, runny nose, and a decrease in semen. Other side effects include headache and tiredness.

How should I take FLOMAX?

FLOMAX 0.4 mg capsules are taken once daily. FLOMAX should be taken approximately one-half hour after the same meal each day. If you stop or forget to take FLOMAX for several days, start again with the 0.4 mg once-daily dose. If you were previously on a higher dose, contact your doctor before returning to the higher dose.

Do not crush, chew, or open FLOMAX capsules.

What about overdosing with FLOMAX?

You should always take your medications according to the directions given by your doctor. If you think you have taken an overdosage of FLOMAX capsules, contact your doctor immediately.

Still have questions?

For more information, ask your doctor or pharmacist, call 1-866-432-9734, and/or visit www.4FLOMAX.com.

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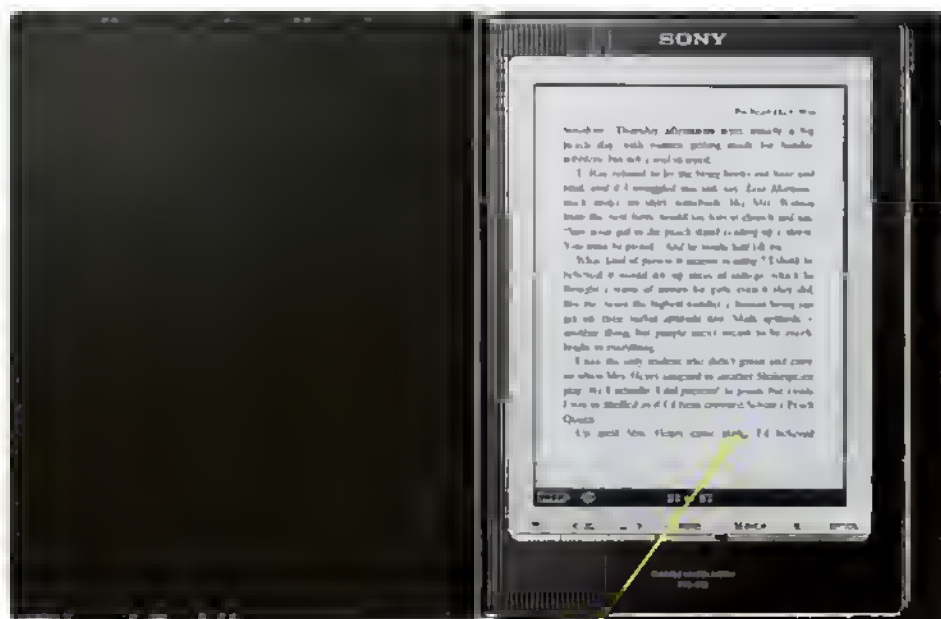


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FL-BSC(02/08)



Push E-Mail

After the iPhone's success, other manufacturers rushed touchscreen phones to market. Not the maker of BlackBerries—RIM has been biding its time, working on a way to better simulate a keyboard. The result: The *BlackBerry Storm* (price not set), which has a touchscreen that depresses like a button, providing a satisfying click. blackberry.com

Because it doesn't flicker, E Ink's paperlike image is easy on the eyes. But, like paper, it can't be read in the dark. The touchscreen *Sony PRS-700 Reader* (\$400) is the first E Ink reader with a built-in backlight. sonystyle.com

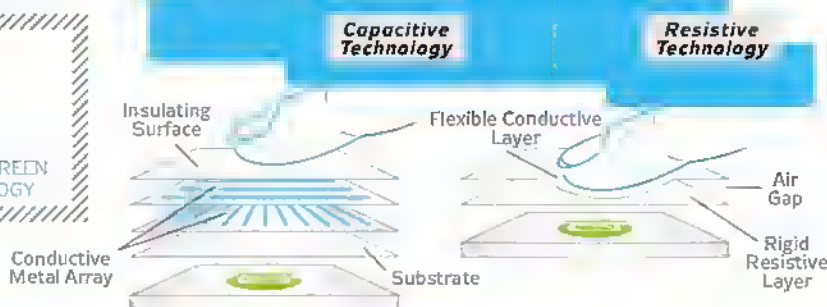


Amphibious Navigator

Landlubbers and seafarers typically require different GPS navigators. The waterproof *Garmin GPSMAP 640* (\$1200) is outfitted with both road and marine maps and modes, allowing it to pull double duty on the dash of a car and the instrument panel of a boat. garmin.com

How It Works

TOUCHSCREEN TECHNOLOGY



Capacitive Touchscreens

The screen has layers of electrically charged metal particles. The device detects touch by sensing where your finger's natural charge interacts with the screen's.

PROS: More sensitive than resistive screens. Can sense when a finger is approaching, allowing it to front-load processes. Allows multitouch.

CONS: Requires contact with skin (or a special conductive stylus). Expensive. Water and dust can interfere with the electrical current.

FOUND IN: Apple iPhone, T-Mobile G1, laptop trackpads, BlackBerry Storm (see above).

Resistive Touchscreens

A flexible conductive top layer is pushed down against a rigid resistive bottom layer. This contact completes a current, signaling the point of impact.

PROS: Can sense pressure from any object (including a stylus). Relatively inexpensive. Not affected by water or dust.

CONS: Not as sensitive as capacitive screens. Requires pressure. Not useful for multitouch. Multiple screen layers block a lot of light.

FOUND IN: Nintendo DS, most ATMs, Garmin GPS devices, Sony PRS-700 Reader.



Great melodies aren't always planned. The **Ovation iDea Guitar (\$860)** has a built-in digital recorder that captures spontaneous songwriting. The guitar's pickup grabs the sound of the strings, while a built-in microphone records any vocals. The songs are saved as MP3s and can be uploaded directly to a PC for editing and sharing. ovationidea.com



The **Weber Q 140 (\$280)** is a portable electric grill that packs in almost as much power as propane. Will charcoal purists scoff? Of course. But this could be the easiest grill option for apartment dwellers, for anyone else who faces restrictions on open flames, and for situations where an outlet is easier to find than fuel. weber.com



Easy Opener

Adjusting a bench vise typically requires tediously hand-cranking the jaws open and closed. The **Ridgid XF-45 4 1/2-in. Quick Grip Forged Vise (\$296)** is as easy to open as a zipper. When its spring-loaded trigger is pulled, the jaws easily slide open to the desired width. And because it is forged from solid steel, it's stronger and more durable than the common cast vise. ridgid.com



Most knives aren't built to pull double duty as chisels.

The steel **Duluth Trading Co. Hacking Knife (\$17)** has a 1/4-in. backside that is designed to take hammer hits without breaking or mushrooming, allowing the blade to brute-force its way through roots, leather, rope or wood. duluthtrading.com



Pipe Pincher

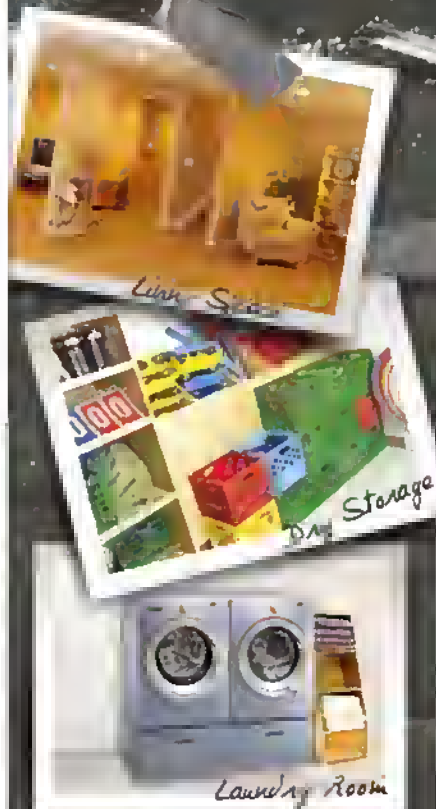
Cutting pipes with a conventional ratchet tool is slow, tiresome and difficult to do in tight spaces. The **Milwaukee M12 Copper Tubing Cutter (\$180)** is the first power tool to make this job easier for the small pipes homeowners usually encounter, up to 1 in. in diameter. In our tests, the spinning blade sliced through copper in seconds. milwaukeetool.com



Planetary Playlist

XM and Sirius each have their own strengths—XM has always had smaller and more advanced portable players, while Sirius does a better job of attracting top-flight talent. Now that the former rivals have merged, satellite subscribers can enjoy the best of both. XM's **Pioneer XMP3 (\$280)** is the smallest, most feature-filled portable satellite radio yet, and one of the few that can also play MP3s (from micro-SD cards). And because of the merger, subscribers can tune into premium packages that allow them to do the once-unthinkable: Listen to Howard Stern on XM. xmradio.com

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*UL Labs, 2005



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CROSSOVER + PICKUP
SPORT SEDAN



NEW CARS

Full Circle

SUVs and even relatively fuel-efficient crossovers are languishing on dealer lots. So Toyota is cutting the family-wagon segment one slice thinner. The Venza is, in large part, a Camry station wagon. Yet it's impossible to detect the shared parts. There's unique metal outside and smart touches inside. Toyota has carved out a nook for your smart phone and provided routing for the charging cord, too. Best of all, the Venza doesn't drive like a snoozy Camry. Engineers firmed up the suspension, tightened the electric power steering and shod even base-level Venzas with big 19-in. wheels. The result is a taut, fun experience. Lead-footers can choose the 268-hp 3.5-liter V6. But as we found on our drive in the rolling hills outside Pittsburgh, the all-new 182-hp 2.7-liter four-cylinder provides plenty of thrust while returning 29 mpg on the highway. All-wheel drive is available, as is a 3500-pound towing capacity. And all Venzas have three 12-volt power outlets and over 70 cu ft of hauling space.

— BEN STEWART



2009 Toyota Venza Base Price: \$26,695



Showtime

The new Ford Mustang was a hit at November's 2008 LA Auto Show. But for GM, perhaps its biggest introduction of the year happened not at an auto show, but at the company's centennial celebration in September. That's where we saw the production Volt for the first time. Here are a few of the other reveals that made news at recent auto shows. —B.S.



2010

Nissan 370Z

Nissan's legendary Z sports car gains important performance upgrades to partner with a fresh look. The body shell of the 370Z is now stiffer, and under the hood sits a new 332-hp 3.7-liter V6. The Z's suspension has been redesigned to reduce weight and improve handling, thanks to forged aluminum links and a lighter stabilizer bar. Look for a new interior with updated materials, too.

2010 Ford Mustang

The ponycar's competition is fierce these days. So Ford will boost the Mustang's game with significant styling upgrades. Every body panel except the roof has been replaced. Sequential taillights—like a '65 T-Bird's—grace the rear, and a pronounced hood bulge was added. Even the Stang's horse badge was redesigned. Inside, upgraded materials create a richer cockpit. The biggest news is a cold-air intake on the 4.6-liter V8 that increases power to 315. Engineers also raised the V8's rev limit to 6500 rpm and retuned the suspension to handle bigger tires. Let the burnouts begin.



2010 Mazda3

The Mazda3 will use both 2.0-liter and 2.5-liter four-cylinder engines. The latter comes directly from the new flagship Mazda6 sedan and should produce 167 hp. The Mazda3 is only slightly larger than the current model and has improved aerodynamics, so fuel economy should remain the same. Upscale features will include adaptive (swiveling) front headlamps and a larger nav screen.

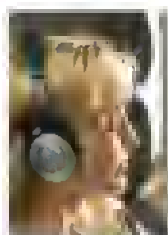


2011 Chevy Volt

The Volt concept was unanimously praised for its athletic stance and fresh design when it debuted at the 2007 Detroit Auto Show. The look may have changed, but the mission hasn't: to provide a range of up to 40 miles on electricity alone, with a 16-kilowatt-hour lithium-ion battery pack, and make that battery pack last 10 years. These are tough goals, but GM insists the Volt project is right on track.

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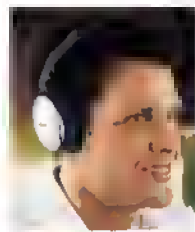


cabin, the bustle of the city or the distractions in the office, Bose QuietComfort 2 headphones help them fade softly into the background with the flick of a switch. You can savor delicate musical nuances without disturbing others. And

when you're not listening to music, you can slip into a tranquil haven – where you can relax and enjoy peace and solitude. Clearly, these are no ordinary headphones. It's no exaggeration to say they're one of those things you have to experience to believe.

"It's as if someone behind your back reached out, found the volume control for the world, and turned it way, way, down," reports *TechnologyReview.com*. Bose QC² headphones incorporate patented technology that electronically identifies and dramatically reduces noise, while faithfully preserving the music, movie dialogue or tranquility you desire. We designed these headphones primarily for airplane travelers. But owners soon started telling us how much they enjoy using them in other places to reduce distractions around them. They're excellent for listening to music whether you're on the go, at home or in the office.

"Forget 'concertlike' comparisons; you'll think you're onstage with the band." That's what *Travel + Leisure Golf*



said when these headphones were first introduced. You'll relish the sound of a bass guitar. Or a flute. Or the delicate inflections of a singing voice. The audio is so clear you may find yourself discovering new subtleties in even your favorite music.

"The QuietComfort 2 lives up to its name, enveloping you in blissful sound in the utmost comfort. It's easy to forget they are on your head." That's what respected



columnist Rich Warren reports. To enjoy peace and tranquility, simply turn them on. To add Bose quality sound, attach the included audio cord and connect them to a laptop computer, portable CD/DVD/MP3 player, in-flight audio system or home stereo. They also offer a fold-flat design for easy storage in the slim carrying case.

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1

2009
Suzuki
Equator

First-Time Player

Does this truck look familiar? It should—it's really a Nissan. A Suzuki pickup is a natural, given the company's lineup of dirt bikes and ATVs. So Suzuki partnered with Nissan to create the Equator, a Nissan Frontier with unique design details. Considering that the Frontier is one of the best midsize pickups on the market, it's quite a smart partnership. The Equator's powertrain includes a 152-hp four-cylinder or

261-hp 4.0-liter V6. We drove the Equator in Texas Hill Country outside San Antonio. Despite the enhanced trail capability of the RMZ-4 off-road package, the ride was surprisingly smooth. We flogged the Equator on a devilish little off-road course, climbing rocks, fording a river (right up to the rocker panels) and tackling plenty of just plain nasty terrain. The Equator soaked it all up effortlessly. Rocks and logs clanged off the skidplates, but nothing slowed or stopped our pickup. Expect base Equators to start around \$18,000 and deliver about 17 mpg city and 22 mpg highway. —KEN GROSS

2

2009
Chevy
Traverse

Family Solitude

In the bad old days, when a manufacturer built a fourth vehicle off a common platform, there was little—if any—excitement left. Been there, right? The Traverse shares its mechanical makeup with the GMC Acadia, Saturn Outlook and Buick Enclave, and that includes the 3.6-liter V6. But here's the difference: You won't mistake the less expensive \$28,990 Chevy version for the others. The Traverse

The Equator's off-road package comes with a beefy electric locking rear Dana 44 axle, Bilstein shocks and electronic hill-descent control.

has unique sheetmetal. Our take? We dig the design. The Traverse has a tough stance for an eight-passenger crossover. The longer you drive, the more you appreciate the chassis. The balance between ride and handling is excellent—even on the terrible streets of Detroit. The Traverse handles quick maneuvers with alacrity. We were impressed with the quietness, too. Very little wind or tire noise intruded on the cabin, so we never had to crank up the volume to hear our XM radio. —JIM MCCRAW



1

2010
VW Golf

Easter Bunny

We've just hammered the new sixth generation Golf on some of the wettest and roughest Nordic roads imaginable near Reykjavik, Iceland. Most of our time was spent with the same 2.0-liter diesel that comes in the Jetta TDI. The sound insulation is exemplary. At speed, there's a little rustling around the door mirrors, but then you look down and realize that you're pushing well past 100 mph. Matched to the six-speed DSG, twin-clutch transmission, the diesel unit is powerful and well-mannered. The Golf will come to the U.S. next spring as the Rabbit. Expect to see this diesel, which could top 50 mpg. Watch out, Prius.

— ANDREW ENGLISH

2

2009
Chevy
Cobalt XFE

Stop-Gap Solution

GM may be racing the clock to debut its Chevy Volt, but that's not helping our wallets right now. We need better fuel economy today. So until the Volt touches down, less glamorous models like the Cobalt are being scrutinized for improved economy. A package dubbed "XFE"—for, ahem, "extra fuel economy"—offers mileage tweaks like

a taller overall gear ratio, an eco-minded shift light and low-rolling-resistance tires. The vehicle is so popular, it required an extra shift at the Cobalt's plant in Lordstown, Ohio. We spent a week with a \$16,330 Cobalt XFE in Los Angeles, pussyfooting the right pedal and keeping an eye on efficiency. Logging over 500 miles through a variety of conditions, we eked out an average of 32.3 mpg, a number fairly consistent with the EPA estimate of 25 city, 37 highway. Best of all, the XFE gear adds nothing to the Cobalt's price tag.

— BASEM WASEF

3

2009
Subaru
Forester
Diesel

The Big Tease

Subaru's diesel Forester is for Europe only. Should it be sold here? We traveled to Austria to find out. The 2.0-liter diesel makes only 145 hp, but there's a full 258 lb.-ft of torque onboard. Since it's paired to a six-speed manual, the Forester almost never feels sluggish. However, the most impressive number is 37.3 mpg. Subaru won't bring the vehicle over unless there's an emissions breakthrough that won't require an expensive urea-injection system. This is a great engine, so that can't happen soon enough.

— JOHN PEARLEY HUFFMAN

PM TEST
DRIVEN



1

2009
BMW
335d

Velvet Hammer

Soon, we'll get one of the meanest oil burners around—BMW's twin-turbo 335d. Up to 2000 rpm, the first turbo peps up the performance of the straight Six. Then when its puff starts to wane, the second blower whooshes in, removing the lag and pumping up the torque. Diesel and high performance don't normally dance together, but the 335d hits 60 mph in 6.0 seconds thanks to 425 lb.-ft. of torque. The 335d is not only quick, it also delivers a nearly 10-mpg boost over gas. The 335d returns an EPA-estimated economy of 23/36. In our testing, we saw only 33 mpg because that intoxicating thrust is impossible to resist. —A.E.

2

2009
Ford
Fiesta

Fueling the Future

In the past, few cared about tiny cars. But last year's fuel-price hike changed that—maybe for good. The economical, Euro-bred Fiesta will allow Ford to integrate its models across the globe, saving money, and the company could certainly use that. The good news

for drivers is it's a solid car and it's coming here. The Fiesta might be the pick of the class in terms of ride and handling. In the metal, particularly in the soft Italian light of Siena, where we drove it, the Fiesta is a real looker. Accommodations are generous up front. And although tall folks in the rear seats will have their legs cramped, there's plenty of headroom—so short journeys are reasonable. The 118-hp 1.6-liter Four delivers 112 lb.-ft. of torque. With variable timing for its twin overhead camshafts, the mill has a docile idle and a 0-to-60-mph time of 9.9 seconds. Ah, but it's gas mileage that we're

For now, only gas-powered Fiestas will arrive in the U.S. But we hope they bring over the 1.6-liter turbodiesel—and the 56 mpg highway that will come with it.

concerned with, isn't it? This one delivers around 40 mpg on the highway. Ford has never produced a more refined engine for such a small car. This smooth operator rivals the Honda Fit. In terms of fun per buck, the Fiesta gets our vote. And you don't get your eyeballs rattled in their sockets as a result of the taut handling, either. Expect base prices under \$15,000. —A.E.

Fuel Fighters

The debate between hybrid and diesel rages on message boards around the Web. Both drivetrains accomplish the same goal—improved fuel economy. But to find out which one could be the better solution, we decided to pair up two eco heavy hitters—the Toyota Prius hybrid and the new VW Jetta TDI. So which one's the champ?



PM TEST
DRIVEN

2008
Toyota
Prius

PRICE: \$22,660
POWERTRAIN: 110 HP, 1.5-LITER,
FOUR-CYLINDER, ELECTRIC DRIVE
FUEL ECONOMY/CITY: 45
FUEL ECONOMY/HIGHWAY: 45



\$22,640: PRICE
140 HP, 2.0-LITER, FOUR-CYLINDER,
DIESEL/6A: POWERTRAIN
32: FUEL ECONOMY/CITY
45: FUEL ECONOMY/HIGHWAY

2009
VW Jetta
TDI



HOW WE TESTED

THE CARS WERE SUBJECTED TO A 478-MILE, TWO-DAY MARATHON DRIVE NEAR LOS ANGELES. FIRST, AN 11-HOUR, 238-MILE SLOG THROUGH TRAFFIC. WE NEVER ENTERED A ROAD WITH A SPEED LIMIT HIGHER THAN 45 MPH. THE SECOND WAS FAR EASIER—AN ALL-HIGHWAY ROAD TRIP WITH CRUISE CONTROLS LOCKED AT 65 MPH.

The City

The Prius gets its power from a 76-hp 1.5-liter four-cylinder with 82 lb-ft of torque hooked to a continuously variable planetary gearset. The engine is boosted by two electric motors for a total of 110 hp. We expected the Prius to dominate our city test, and it did. Every time we hit a red light or traffic snarl, the Prius would sit silently—burning absolutely no fuel. But the Prius's overall 44.7 mpg was still about 3 mpg less than the EPA city figure of 48.

The Highway

Our test loop took us from the cool ocean breezes of Santa Monica to the hot desert winds near Palm Springs. On the Interstate 10 freeway cruise, the Prius delivered a nearly identical fuel economy figure of 44.8 mpg.

The City

The Jetta is a sport sedan compared to the Prius. Under half-throttle or less, the Jetta TDI moves with ease that speaks to its impressive torque figure—236 lb-ft. And the engine is paired to VW's brilliant six-speed DSG transmission. The Jetta can loaf along, shifting at around 1500 rpm while still providing enough acceleration to keep up with the flow of traffic. But as fun as the Jetta was, it could only muster 32 mpg. Still, that was 2 mpg better than the EPA rating.

The Highway

Since the Prius dominated the city, we were hoping the highway portion might provide a closer result. Over the exact same route at the exact same speeds, the Jetta eked out a narrow fuel-economy victory with a mark of 45.4 mpg.

The Bottom Line

It appears clear, no matter what the driving conditions: The Prius returns about 45 mpg. That's impressive. Yet the diesel Jetta can match the Prius on the highway. Economy aside, if it comes down to which of these two popular and efficient cars is more fun and more comfortable to drive every day, that's an easy pick: the Jetta TDI.

TOUGH SLEDDING

> BY JEFF WISE

> ILLUSTRATION BY TIN BOWER



A NEW BREED OF EXTREME SLEDS IS BRINGING THE CHILDHOOD PASTIME OUT OF THE BACKYARD AND INTO THE BACKCOUNTRY.

Come winter, Vermont's Lincoln Gap Road undergoes a radical transformation. As mounds of fresh snow turn the region into a frozen Narnia, the rustic thoroughfare over the Green Mountains becomes inaccessible to traffic and converts to an informal test track for snow-sport maniacs. The road twists and turns as it winds down the 2400-ft pass through a wooded terrain larded with frozen waterfalls and cliff faces perfect for hucking off.

We're not talking about skiing. Or snowboarding. We're talking sleds.

Recently, an extreme underground sledding movement has been brewing in the woods of New England, where a hard core of daredevils has become proficient at wringing eye-popping maneuvers from high-tech equipment. Aficionados call their pastime free sledding, performance

sledding or extreme sledding, and it's about as far from backyard tobogganing as big-wave surfing is from a Slip 'N Slide. To get a taste for the scene, I decide to make a trip to its birthplace.

On a snowy winter morning in Warren, Vt., I meet up for breakfast with the presidents of two local sled companies: Whitney Phillips of Mad River Rocket and Steve Lühr of Hammerhead Sled. They both bring a couple of their sleds along, and I've brought two other models as well.

We head south of town and turn off the highway onto the unplowed Lincoln Gap Road. Soon the grade steepens, and my tires start spinning in 4 in. of fresh powder covering a winter's worth of hard-packed snow. I'm forced to pull over and park. Meanwhile, Phillips unloads his snowmobile from his trailer and begins shuttling our trio and its snow toys to the top of the gap.

First up is the Mad River Rocket Killer B, a cushioned plastic tub you ride in a kneeling position. To steer, you lean back and to one side, dragging an arm for extra-tight turns. The learning curve is steep, and I have the distinct feeling that I am out of control. As I build up speed, the sensation intensifies. The first turn is coming, and beyond it hangs a good 50 ft of empty air punctuated with tree tops. I lean to the right. The sled goes straight. I lean a little more, and suddenly whip around and tumble over before sliding to a stop.

The fact is, the Killer B's bowl bottom is just not very effective on thin snow. "It's great for deep powder, the backwoods and backflips," Lühr says admiringly of his competitor.

We climb the hillside above the road, and Phillips demonstrates by slaloming around trees and popping off the top of boulders. I try to mimic

his stunts, but about the best I can say is that I don't kill myself.

Given that a high-speed crash seems inevitable, I move on to the Swiss-made Airboard Classic 130, which looks a bit like a rideable airbag with handles on top. I get it instantly—it's just like steering a boogie board—and on my first attempt I take a fast run all the way to the bottom. Nothing inflatable is ever going to be a precision instrument, but when I hit a bump and suddenly find myself airborne, the instant is pure thrill, and I'm relieved to find the inflatable sled does a fine job of protecting my body from damage. My confidence is so high that I drag the Airboard up into the trees and take it careening off a jump, over and over. Half the time I hit the landing wrong and go tumbling down the slope (but in a good way).

The Airboard has stoked my appetite for speed, so I move on to the Hammerhead, which looks like a cross between a Flexible Flyer and a

webbed Aeron Chair. The Hammerhead is the most intuitive of the sleds—just lie belly down and steer by turning the front runners. The tensioned webbing absorbs bumps, and the scooped runners let you carve turns on all but the crustiest snowpacks. It's not built for close-in work or jumps—I don't even bother to try it in the woods—but on the road run, the Hammerhead is by far the fastest sled I've ever ridden.

In contrast, tearing down an icy road on the Swedish-designed Stiga Advance FSR feels like trying to drive my nephew's tricycle on the freeway. As I grip the tiny steering wheel, my high center of gravity makes me feel like I'm balancing on a teacup. But such imbalance doesn't detract from the Stiga's true calling—this is a stunt sled. YouTube is filled with videos of daredevils using the sleds to pull backflips off roofs. Unfortunately, I can't convince Phillips to try for some upside-down air.

By the end of the afternoon I'm

soaking wet and joyously exhausted. And there's the rub: Unless you have a chauffeured snowmobile, a day of sledding involves a lot of trudging uphill. What you really want is a lift. Few ski mountains in North America allow sleds on their slopes. But that's changing. This winter, New Hampshire's Tenney Mountain is scheduled to open a sledding zone where guests can rent Hammerheads.

It's a small start, but it could turn into something bigger. After all, everyone already knows about sledding. It's just that what they know is wrong. "People think sledding means going straight until you crash," Phillips says. "In fact, you can sled lines you can't ski. You can go wherever you want. It's the ultimate freedom on the snow." **PM**

ON THE WEB > See more of the latest sleds—and learn how to perfect your snowball-fight arsenal—at popularmechanics.com/outdoors.



				
	Stiga Advance FSR \$90 stigagames.com	Mad River Rocket Killer B \$127 madrivrocket.com	Airboard Classic 130 \$279 airboard.com	Hammerhead \$349 hammerheadsled.com
Build	Steel-tube frame with polyethylene seat and skis	Tripolymer olefin shell (made from recycled dumpster lids) with closed-cell polyethylene foam for knee padding	Thermoplastic urethane synthetic reinforced with nylon fabric; inflatable	Polyester-blend mesh over an aluminum tube frame; high-density polyethylene rear skis and polycarbonate front skis
Weight	15 pounds	7 pounds	6.2 pounds	9.7 pounds
Favored Terrain	Ramps, rails and pipes	Steep woods	Big slopes and jumps	Groomed ski runs
Durability	☆☆	☆☆☆	☆☆☆	☆☆☆☆
Speed	☆☆	☆☆	☆☆☆	☆☆☆☆
Maneuverability	☆☆☆	☆☆	☆☆☆	☆☆☆
Jumps	☆☆☆	☆☆☆☆	☆☆☆	☆

Beyond the Backyard Toboggan

Amish mantle and miracle invention help home heat bills hit rock bottom

Miracle heaters being given away free with orders for real Amish fireplace mantles to announce the invention that help slash heat bills, but Amish craftsmen under strain of Christmas rush forces household limit of 2

Save money: only uses about 8¢ electric an hour; so turn down your thermostat and never be cold again

By MARK WOODS
Universal Media Syndicate

(UMS) Everyone hates high heat bills. But we're all sick and tired of simply turning down the thermostat and then being cold.

Well now, the popular HEAT SURGE® miracle heaters are actually being given away free to the general public for the next 7 days starting at precisely 8:00 a.m. today.

The only thing readers have to do is call the National Distribution Hot-line before the 7-day deadline with their order for the handmade Amish Fireplace Mantle. Everyone who does is instantly being awarded the miracle heater absolutely free.

This is all happening to announce the HEAT SURGE Roll-n-Glow® Fireplace which actually rolls from room-to-room so you can turn down your thermostat and take the heat with you anywhere. That way, everyone who gets them first can immediately start saving on their heat bills.

Just in time for winter weather, portable Amish encased fireplaces are being delivered directly to the doors of all those who beat the deadline.

These remarkable fireplaces are being called a miracle because they have what's being called the 'Fireless Flame' patented technology that gives you the peaceful flicker of a real fire but without any flames, fumes, smells, ashes or mess. Everyone is getting them because they require no chimney and no



■ **GENUINE AMISH MANTLES MADE IN THE USA:** Everyone wants to save money on heat bills this winter, so entire Amish communities are working from the crack of dawn to finish. These fine real wood Amish made fireplace mantles are built to last forever. The oak mantle is a real steal at just two hundred ninety-eight dollars because all those who beat the order deadline by calling the National Hotline at 1-800-918-4312 to order the fireplace mantles are actually getting the imported hi-tech Fireless Flame HEAT SURGE miracle heaters for free.

vent. You just plug them in.

The Fireless Flame looks so real it amazes everybody because it has no real fire. So what's the catch? Well, soft spoken Amish craftsmen who take their time hand building the mantles have a process that forces a strict household limit of 2 to keep up with orders.

"We can barely keep up ever since we started giving heaters away free. With winter just around the corner, everyone's trying to get them. Amish craftsmen are working their fingers to the bone to be sure everyone gets their delivery in time for Christ-

mas," confirms Timothy Milton, National Shipping Director.

"These portable Roll-n-Glow Fireplaces are the latest home decorating sensation. They actually give you a beautifully redecorated room while they quickly beat from wall to wall. It's the best way to dress up every room, stay really warm and slash your heat bills all at the same time," says Josette Holland, Home Makeover Expert.

And here's the best part. Readers who beat the 7-day order deadline are getting their imported hi-tech miracle heaters free when

encased in the Amish built real wood fireplace mantles. The mantles are being handmade in the USA right in the heart of Amish country where they are beautifully hand-rubbed, stained and varnished.

You just can't find custom made Amish mantles like this in the national chain stores. That makes the oak mantle a real steal for just two hundred ninety-eight dollars since the entire cost of the miracle heater is free.

This free giveaway is the best way to slash heating bills and stay warm this fall and winter. The HEAT SURGE

HEAT SURGE® Fireless Flame

How It Works: The HEAT SURGE miracle heater is a work of engineering genius from the China coast so advanced, you simply plug it into any standard wall outlet. It uses only about 8¢ of electric an hour on the standard setting. Yet, it produces up to an amazing 5,119 BTU's on the high setting. An on board Powerful hi-tech heat turbine silently forces hot air out into the room so you feel the bone soothing heat instantly. It even has certification of Underwriters Laboratories coveted UL listing. It also comes with a limited full year replacement or money back warranty plus a 30-Day Satisfaction Guarantee.



Hot air comes out

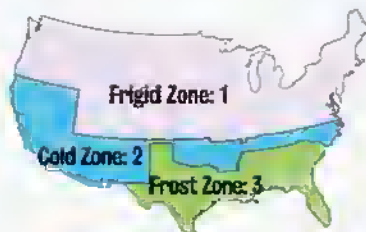
Hi-tech silent heat turbine takes in cold air

How to get 2 free heaters

The National Toll Free Hotlines are now open. All those who beat the 7-day order deadline to cover the cost of the Amish made Fireplace Mantle and shipping get the HEAT SURGE miracle heater free.

A strict limit of 2 per household has been imposed. Since some home woodworkers want to build their own mantle piece, they are letting people get the imported miracle heater alone for just \$249. Or, with the Amish made mantle you get the miracle heater free.

Use the map below to locate the weather zone you live in and call the Hotline number for your zone.



Claim Code: FP6100

EVERYONE LIVING IN THE

Frigid Zone: 1

START CALLING AT
8:00 A.M. TODAY
1-800-918-4312

EVERYONE LIVING IN THE

Cold Zone: 2

START CALLING AT
8:30 A.M. TODAY
1-800-716-2513

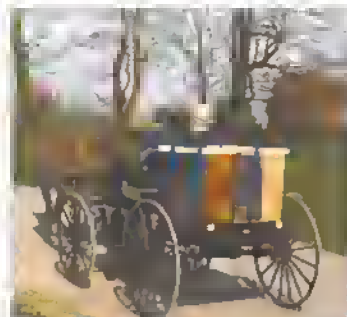
EVERYONE LIVING IN THE

Frost Zone: 3

START CALLING AT
9:00 A.M. TODAY
1-800-695-3077

FOR HEAT SURGE, LLC 2033 EVERHARD RD., CANTON OH 44705

©2008 HEAT SURGE PASTOR DREZZER 1



■ **ON THEIR WAY:** Christmas orders have turned country roads into pipelines to the big city delivery system. Everybody wants a fireplace that comes fully assembled with a handmade Amish mantle in oak or cherry finish and gets delivered by truck right to your door. All you do is plug it in.

Roll-n-Glow Fireplace gives you zone heating and all the beauty and warmth of a built-in fireplace but rolls from room-to-room so it can also save you a ton of money on heating bills.

Even people in California and Florida are flocking to get them so they may never have to turn on their furnace all winter. And since it uses only about 8 cents of electric an hour on the standard setting, the potential savings

are absolutely incredible.

"We are making sure no one gets left out, but you better hurry because entire communities of Amish craftsmen are straining to keep up with demands. For now, we are turning away all dealers in order to let readers have two per household just as long as they call before the deadline," confirms Milton.

It's a really smart decision to get two right now because

for only the next 7 days you get both miracle heaters free. That's like putting five hundred bucks right in your pocket and you can save even more money on your monthly heating bills.

"Everyone's calling to get one but those who are getting their Christmas shopping done are surprising the whole family by getting two. So when lines are busy keep trying or log onto

amishfireplaces.com. We promise to get to every call. Then we can have a delivery truck out to your door right away with your beautiful Heat Surge Roll-n-Glow Fireplace," Milton said.

"You'll instantly feel bone soothing heat in any room. You will never have to be cold again," he said. ■

On the worldwide web:
www.amishfireplaces.com

Rolls anywhere to throw an instant heat wave with no chimney, no vents, no wood and no smoke



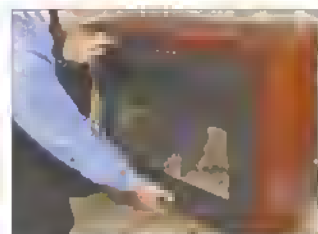
■ **EASILY ROLLS ANYWHERE:** This is the portable Roll-n-Glow® Fireplace that easily rolls from bedroom to living room to keep you warm. No vents, no chimney and no tools. Just plug it in.



■ **SAVES ON BILLS:** Everyone can get low bills and stay warm and cozy. The new Roll-n-Glow Fireplace saves a ton of money and makes your front room look like a million bucks.



■ **SAFE:** The Fireless Flame looks so real it fools everybody but there is no real fire. That makes the flame safe to the touch. It's where the kids will play and the cat and dog will sleep.



■ **FREE:** Get this \$249 miracle heater free. It is being given away free to all who beat the 7-day order deadline for your choice of the oak or cherry finish Amish Mantles. The free heater comes already encased.

REBUILDING THE PAST

> BY JAY LENO

> PHOTOGRAPHS BY JOHN LANM



Jay's extensive car collection includes seven Duesenbergs. These supercars of the '30s inspired the expression "It's a doozy!"

1937. During World War II scrap drives, some of these magnificent cars were actually cut up for the war effort. Today, spare parts are scarce. And there are no spare cylinder heads available. That's right. None, zero, zip.

So when I heard through Duesenberg guru Randy Ema that a guy in Wisconsin named Jim Schneck was going to cast new Duesy heads, I became very interested. Ema has factory records and some of the few remaining spare parts, too—but no cylinder heads.

I had never met Jim, but he came highly recommended, so I thought I'd take a chance. This is one of those things that you do on faith. He owns an unrestored Duesenberg SJ

Brunn Riviera, and he likes to drive it, so he's very familiar with these cars.

People have no idea of the work that goes into recasting vintage cylinder heads. Just making the patterns for those heads took six months. And the heads themselves? They took the better part of three years. The heads are cast iron, so the molten metal mixture has to be much hotter than aluminum. And each head weighs about 185 pounds.

We live in a time when we think everything today is so much better than what came before. But the

Duesenbergs, I love 'em. They called the Duesy America's Mightiest Motor Car. Introduced on the eve of the Great Depression, the Model J had a 420-cu-in. twin-cam 32-valve straight Eight. Peugeot was first with four-valve heads, in 1912, and Bugatti had three-valve heads in the 1920s, so Duesenberg was really using European technology, but on a grand scale. Almost no one did those heads on a 7.0-liter engine. Even today, Americans like to take something small from Europe and make a huge version of it. Take the new Ford Flex; it's like a giant Mini Cooper.

The Duesenberg straight Eight developed about 265 hp normally aspirated and 320 hp with an optional supercharger. To put that in perspective, Cadillac's V8s of the same vintage produced just 90 hp. The Duesy was the supercar of its time. Only 481 Js and SJs were built before production ended in

REMANUFACTURED
PARTS HELP KEEP
CHERISHED CLASSICS
ON THE ROAD.

people who built Duesenbergs were artisans. Back then, foundrywork was an art form. It's so hard to duplicate what they did decades ago. When Jim decided to cast a Duesenberg head he studied the blueprints, but they didn't show what the casting cores looked like.

As you'd suspect, he had casting problems and core shifts, since the sand cores tend to move in the molten metal. But the Lycoming factory in Williamsport, Pa., that built those engines for Duesenberg had similar problems. Jim didn't change the design in any way. And that's good. You want to keep something like this true to the OEM specs, so the car develops its power commensurate with what it had originally.

The new heads look terrific; I bought the first one. They sell for \$42,000 each with the valves installed. Jim's not going to make a lot of money on this project. But he's doing something important. At the auctions, you see Duesenbergs with incredible paint and chrome, and yet inside the motors, they're literally worn out. No one seems to mind. People

buy what they can see. So they spend \$50,000 to \$80,000 on a paint job for a classic car. But you tell them, "Hey, I need a new cylinder head, because mine is corroded," and they say, "Yeah?" and just look at you.

In England, the Bentley Drivers Club is one of the most active old-car clubs in the world, because they have craftsmen to manufacture nearly all the parts you need to keep an old Bentley on the road. But in this country, most people who have an old car like a Duesenberg put it in a garage, and since it's almost never used, nothing breaks. And because nothing breaks, there are no parts available to

fix it. And since it doesn't need to be fixed, the people who know how to make the parts or fix the cars—well, they eventually pass away.

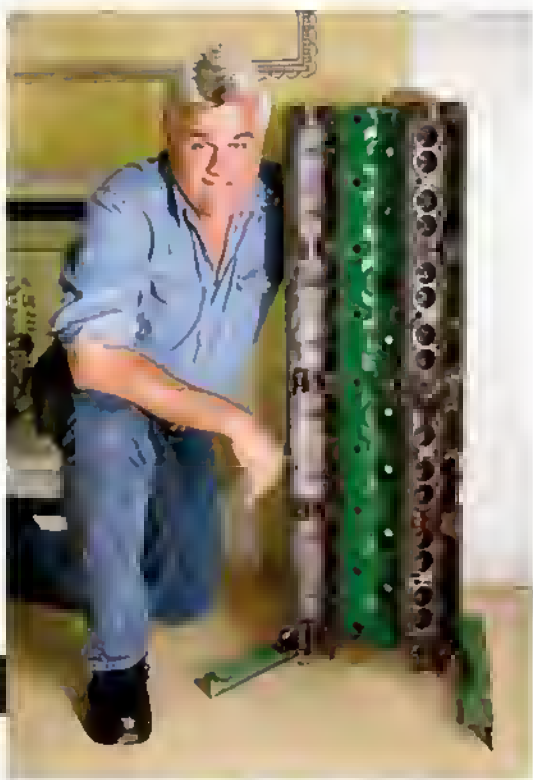
There were plenty of old factory guys around back in the '60s and '70s who could tune a Duesenberg. Setting the valves on one is a 40-hour job. It takes a full week. These cars were built back when technology was expensive and labor cheap. Now, it's the other way around—labor's the killer. Today, it's crazy to pay a guy for 40 hours of work doing valves. Tuning your Duesenberg costs the same as having the service done on a Ferrari Enzo.

You know, we've gotten away from our basic mechanical beginnings. These old cars were designed by real engineers. Over the years, people have done fixes upon fixes to try and improve on that engineering. But if you restore a car exactly the way it was originally, it will work just fine. I drive my Duesenbergs everywhere, and they operate flawlessly—driving them is the best way to keep these cars on the road.

In the '50s and '60s, people still drove old cars every day. In the '70s, guys fixed up old cars and drove them on the weekends. In the '80s, they were put on display and occasionally taken on a tour. By the '90s, they were trailered to events like Pebble Beach, taken off the trailer and barely run at all. What happens next is, they're all in museums.

Duesenbergs are considered one of the "old masters" of the classic automotive world. That encourages guys like Jim Schneck to tool up and make cylinder heads. Now you have a car you can actually drive, not a piece of static art on display. Maybe people will make some other scarce parts as well, like artisans do for the Bentley Club. Perhaps someone will get really brave and cast a cylinder block.

In the past, if you had a Duesenberg motor with a bad head, all you could do was sell it for parts. Thanks to Jim Schneck, you can make that Duesenberg run again. To anyone who plans to re-create a much-needed part for other vintage automobiles, I say: Thank you. You will be revered by those of us who cherish them. **PM**



Jay's massive four-valve Duesenberg cylinder head weighs nearly as much as an air-cooled VW engine.



The 2.3-liter Bugatti engine on Jay's workbench was one of the first with a three-valve head.



THE COAST GUARD'S DIRTIEST JOB

> BY JOE PAPPALARDO

> PHOTOGRAPHS BY SETH JOHNSON

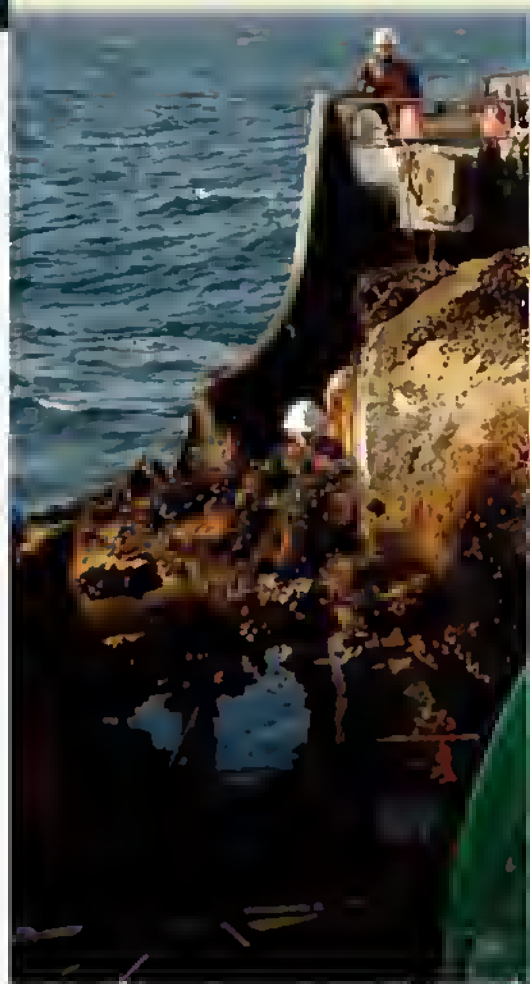


HOW A CREW OF 20-SOMETHINGS KEEPS THE GLOBAL SHIPPING INDUSTRY IN MOTION, ONE BUOY AT A TIME.

All eyes on the bridge of the USCGC *Juniper* dart between navigation screens and a flash of yellow bobbing several thousand yards off the ship's gently pitching bow. The 225-ft Coast Guard ship is cresting whitecaps churned up by 20-knot winds as it slowly approaches its target: a lighted buoy in New York Bay that has not been pulled from the water for service in nearly two years.

It's easy to recognize Coast Guard buoy tenders by their unique jet-black hulls. Given the hard, dirty work they perform, there's just no point in painting the ships white. The *Juniper* approaches the buoy at an angle that will leave it in the lee of the ship, out of the wind and protected from the waves. Working on a reasonably steady deck is vital as the crew pulls tons of metal from the water. For those steering the boat, however, calm conditions pose some challenges.

"The worst ones to work are when you're not fighting against anything," says Ensign Katie Gareau, 24, as she scurries between stations to make sure the boat is on course. "When there's no wind and no current,



Changing Lanes

A redesign of shipping approaches to the Port of New York and New Jersey means extra work for buoy tenders. It took around an hour for the crew of the Coast Guard's *Juniper* (above, left) to haul this shipping-channel buoy out of the water, check its hardware and relocate it farther out to sea. On a recent cruise, *Juniper* replaced, moved or repaired 19 buoys in six days.



there's no force to work against."

On this bright but blustery October day, *Juniper* is on the outer edge of the Ambrose Channel, about 20 miles southeast of Manhattan's southern tip. The channel is a major thoroughfare for the Port of New York and New Jersey, and massive cargo ships laden with garish stacks of multicolored cargo containers line the horizon. More than 2 billion metric tons of globally traded goods travel through coastal channels such as the Ambrose. Anyone who exports goods—or simply buys a cellular phone, fills up a gas tank or saves a

buck at Wal-Mart—depends on the offshore infrastructure maintained by the buoy tender fleet.

In 2005, the U.S. Army Corps of Engineers issued contracts to deepen the Ambrose and six more channels in Upper New York Bay and to widen the port's approaches. The work will open the way for a new generation of huge international container ships that require 50-plus-ft-deep channels. The new approaches need to be clearly marked, so *Juniper* has been tasked with relocating a yellow buoy to a spot nearly a mile

away, marking the new edge of a precautionary zone where inbound ships must slow down and start maneuvering into a channel.

The deckhands—who generally are younger than the crew's average age of 26—have inked their helmets with nicknames: Leonidas, Dirt McGirt, Sibs and so on. A New York City classic rock station plays as they slouch against heavy equipment, oblivious to the stale fish-tank smell and the ship's seesaw rocking.

Their jobs onboard are indicated by their helmets: white helmets for the buoy deck supervisors, blue for

INFRASTRUCTURE/// COAST GUARD CREWS

crew trained and qualified in a specific task and green for rookies.

When Gareau and the other ensigns on the bridge ease the ship alongside the buoy, the deckhands straighten up and adopt a professionalism that belies their youth. Chief Warrant Officer Mike Tumasi, the white-helmeted, 41-year-old deck officer in charge of safety, watches intently from a perch just above the buoy deck, where he can see all and shout questions and advice. One of the riskiest moments for the buoy tender crew has arrived.

A deckhand tosses a rope over the top of the buoy, and one of his shipmates leans over the gunwale, placing his torso between the heaving buoy and the ship, to secure the end of the line. To minimize the risk, the green-helmeted crewman jabs at the rope with a reeving line—a pole with a special clasp that catches loose lines. (Coast Guard crews call the tool the "happy hooker.") Speed matters. A wave pushes the buoy toward the *Juniper* as the Coastie spears the line. He draws back just before the buoy slams into the hull and rebounds with a shudder.

Two deckhands slide a heavy hook through an eye on the buoy, and deck supervisor Chief Keith Frost gestures to the crane operator, who controls a 65-ft boom. The crane's arm rises, pulling the buoy and several yards of mollusk-encrusted chain out of the water, and slowly deposits the dripping mess onto the deck.

Fully exposed, the 35-ft-long buoy looks like a floating lighthouse, with a metal tower built on its round, 9-ft-wide base. A guano-smeared solar panel crowns the tower. Mariners divine the meaning of a buoy by its shape, color and pattern of light flashes. Depending on their purpose, some buoys are outfitted with radar transmitters, large metal bells or hollow shafts that use wave motion to drive air into a warning whistle.



Forging the Links

Seaman Adam Wernicke cuts a 1.5-in. chain in need of replacement. Buoys are connected to sinkers that sit on the seafloor with a length of chain three times the depth of the water. Most of the links lie on the bottom, providing slack to reduce the stress on the chain.

As soon as the buoy is secured with chains and rope, the rest of the crew swings into action. Some use pikes to hack at the black and green shag of accumulated ocean growth on the base. Displaced blue mussels and a feathery mat of sea-creature colonies fall to the deck. A deckhand promptly shovels it all overboard.

The crane operator also controls an 8-ft-high inhaul winch, which he uses to slowly draw in the length of chain that is connected to an 18,000-pound concrete block called a sinker. The sound of the winch hauling the slab off the seabed is like

a Hollywood castle's portcullis being raised. The crew measures the thickness of the links, looking for signs of wear. The part of a chain that curves before it settles to the seafloor always weakens fastest, and now this section needs to be replaced. A hand-torch-qualified Coastie cuts through existing chain, flings the smoking metal aside and then heats a pin and shackle to a red-orange glow. Two deckhands then rhythmically pound the pinhead into a mushroom with alternating blows of their sledgehammers.

It is time to "shoot the tube." A green-helmeted rookie bends at the knees, scraper in hand, and dives into the hollow shaft to attack the ocean growth within and ensure that air can reach the whistle. The 3-ft-wide shaft is large enough to accommodate a person on hands and knees. It smells like a crab basket left overnight in the backyard. The buoy rests at an angle, so that anyone inside risks sliding down the slick surface. Soon, the only sign of the deckhand is the pulses of organic debris sliding out of the tube onto the deck.

While this unpleasant duty is underway, Savannah Sibley, a 20-year-old seaman, climbs to the tip of the buoy, which is jutting several feet off the port side of *Juniper's* deck, and snaps into a safety harness. There is nothing but 57°F water beneath her. She checks the status of the light to make sure that none of the yellow, flashing bulbs have burned out. They haven't. These low-watt blinkers seldom do, unlike the steady, bright-white lights of other buoys. The Coast Guard is gradually replacing the traditional bulbs in most of the thousands of buoys it services. The installation of new, tougher LEDs is enabling buoy tenders to stretch the interval between maintenance checks

from two years to three. With less time spent on buoy maintenance, the ships are free to take new missions—breaking ice, boarding commercial fishing boats and providing offshore security for special events. Last spring, *Juniper* spent a solid month at sea, a trip twice as long as most buoy-tending missions, intercepting illegal immigrants in waters between Florida and Cuba. The extra time

takes its toll. "I have a teenage daughter who freaks out every time I get underway," says one crew member who works in *Juniper's* galley. "The longer I'm gone, the harder it is."

The vessel's captain, Cmdr. Rick Wester, says that the creation of the Department of Homeland Security changed the way the tenders are regarded. "The transfer [from Department of Transportation to DHS] led to a higher visibility of our capabilities," he says. "Our schedule is dependent on the buoys; whatever time is left is for law enforcement." He calculates that 39 percent of *Juniper's* time at sea is now spent maintaining buoys, down from 70 percent when he took command in June 2006.



Keeping the Lights

Seaman Savannah Sibley replaces a buoy's old incandescent light fixture with an LED apparatus. The new lights are more durable and are expected to last 10 years, several times longer than the system they are replacing. The Coast Guard is slowly swapping the traditional bulbs in most of the nation's 5000 buoys.

On deck, the buoy is now cleaned and ready for its new home, 4500 ft west of the previous site. The crane operator lowers the 9-ton sinker with the winch, then uses the crane's main arm to carefully slide the buoy off the gunwale of the ship. Its base hovers just above the water's surface. The deckhands quickly detach the lines and the crane lowers the buoy into the water with a small splash. Air rushes through the clean tube

and its whistle releases a triumphant honk.

Juniper slides away from the buoy, which is now bobbing serenely, right at the border between civilization and open water. As the ship gets farther away, the noise of the wave whistle fades. The crew, with three more buoys left on the day's schedule, doesn't look back. **PM**



ON THE WEB >

Watch the *Juniper's* crew work buoys off the coast of New York City at popularmechanics.com/juniper.



BRINGING HOME THE EPIC

It's about time. With hi-def discs and downloads now widely available, Hollywood is finally tackling the job of turning film classics into digital masterpieces.

THE COLOR OF MONEY, EVERYBODY KNOWS, IS GREEN. THE COLOR OF POOL TABLE FELT in Martin Scorsese's 1986 movie *The Color of Money* is ... blue? Wait a sec—rewind. That's not quite right, is it? Actually, it's wrong. The blue pool tables in *The Color of Money* have nagged the makers of the film since it was shot. When Scorsese began preproduction on the sequel to the classic movie *The Hustler*, he toyed with the idea of shooting in black and white. The studio, Touchstone, wasn't crazy about the idea, so Scorsese opted instead to "paint with color" for this story of an aging pool shark (Paul Newman) and his cocky young protégé (Tom Cruise). For the first two-thirds of the film, which takes place largely in a wintry Chicago, Scorsese, production designer Boris Leven and cinematographer Michael Ballhaus designed the film in gray, black and white. The results were striking, with one slight hitch: "Because of the nature of the lighting, the green felt of the pool tables kept going blue," recalls film editor Thelma Schoonmaker, a longtime Scorsese collaborator. "There was nothing we could do about it, because we wanted to make sure the skin tones were right, and the overall look of the film was right; so we let it go."

Last summer, Schoonmaker was at New York's Technicolor Creative Services staring at those blue pool tables again. When the film was first made, there was no fix for the problem, but thanks to digital technology, she could now correct it easily. "All we had to do was open digital windows

Thanks to hi-d formats and painstaking restorations by Hollywood craftsmen, home theaters can now re-create the visual and aural glory of 35 mm film.

By Glenn Kenny

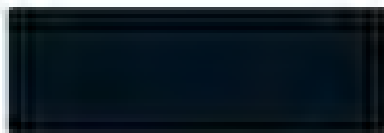
Photographs by Dan Saelinger

on the pool tables and fill them in with green, without affecting the rest of the shot," Schoonmaker explains. Why was a multiple-Oscar-winning editor concerned with color correction on a 20-year-old movie? Because, like many classics from Hollywood's archives, *The Color of Money* is about to be reborn.

HOME THEATER, THE NEW THEATER

THE MOVIE INDUSTRY IS AT A TECHNOLOGICAL turning point. The era of high-definition video, which has already transformed the broadcast and cable television industry, is just starting to make its impact felt in Hollywood. After a six-year format war, Sony's Blu-ray hi-def disc emerged last year as the winner over rival Toshiba's HD-DVD, paving the way for studios to jump onboard and release a library of beloved movies in HD. Some consumer skepticism is understandable. Didn't we all just upgrade from VHS to DVDs a few years ago? The mass-market appeal of HD discs is still unproven—at around \$20 to \$30, Blu-ray discs are expensive and, although the prices of players are falling, they are only beginning to break the \$200 mark. Yet if the sales of HDTV sets are any indicator (47 percent of American households now own one), there is considerable consumer interest in hi-def, especially among those who love movies and home theater. And the term home theater has never been more apt—HD source material for movies is currently available at resolutions up to 1920 x 1080 pixels (known as 1080p), six times the resolution of DVDs. Now a homeowner with a quality screen and audio setup can not only approximate the feeling of a movie theater, he can arguably improve upon it. After all,

As classic films get the HD treatment, filmmakers can correct everything from gaffes to annoyances, such as *The Color of Money*'s blue pool tables (below).



the home-theater environment is calibrated by and optimized for the guy on the couch who owns it. No long lines, bad seats, awkward viewing angles or sticky floors. And if anybody talks during the movie, it's probably you.

The advent of high-definition home cinema—whether delivered by Blu-ray discs or a variety of new downloadable technologies—presents moviemakers with a great new opportunity to bring the movie theater experience directly to living rooms. But it also presents new challenges, both technical and artistic. For one, many consumers buy HDTVs that are optimized for sports viewing, not for the nuances of classic films. And studios sometimes don't understand how to take advantage of HD's tack-sharp picture quality—or worse, they use it in ways that undermine the look and feel of the original film. So it's up to the directors, cinematographers, editors and restoration experts to answer one very important question: How should a movie look and sound in the home-theater environment?

FOR AND AGAINST THE GRAIN

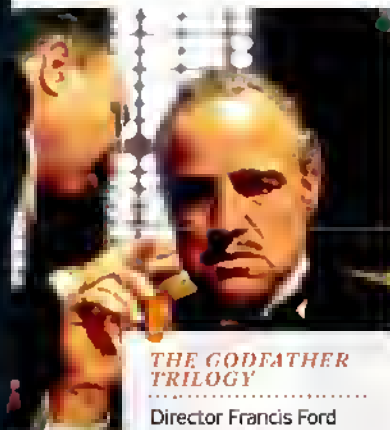
TO UNDERSTAND THE MAMMOTH EFFORT IT takes to transfer a classic film, POPULAR MECHANICS visited the facilities where the Criterion Collection restores its movies. Criterion is legendary for its painstaking remastering jobs. These days, most of what we refer to as "film restoration" isn't done on film. "There could be multiple copies of film elements, original negatives or duplicate negatives," says Lee Kline, Criterion's technical director. Criterion gathers the best it can find, then transfers those elements to the digital domain. Most are transferred using high-definition DataCine, where film is scanned in near real time (24 frames per second) directly to uncompressed data files. But in the case of fragile negatives, restorers often choose the more painstaking method of digitally scanning individual film frames using a scanner synchronized to sprocket holes at the edges of negatives.

After it is scanned, each movie is sent to Criterion's facility on HD CAM cassettes at full 1080p high-definition resolution and is uploaded in the company's central machine room.

Then the fun begins. A technician in a small office sits in front of a computer monitor with a virtual pen and touchpad and goes through the movie frame by frame, fixing scratches, removing dirt and schmutz. Take, for instance, Criterion's painstaking restoration of art-house favorite Wong Kar Wai's *Chungking Express*. The film's opening sequence is in slow motion, but rather than create that slow motion in camera, Wong Kar Wai

Top 10 HD Epics to Own

Every movie buff needs a library of classics to show off his HD system. These films reward repeat viewing with great stories, evocative soundtracks and dazzling visuals. Here are the movies hi-def was made for—and they're just the beginning. —G.K.



THE GODFATHER TRILOGY

Director Francis Ford Coppola and cinematographer Gordon Willis spent 18 months on this HD restoration. The team's decision to recreate the Technicolor look—including the film grain of the first two pictures—was controversial. But look at Michael Corleone's Italian-restaurant revenge scene in the first picture and you'll see the atmosphere is perfect.

LOOK FOR: Detail in dark areas, one of the marks of a good transfer. "People see all those subtleties," says Lee Kline, technical director at Criterion. "They just don't know it." Too much digital editing makes shadows look crushed.



CLOSE ENCOUNTERS OF THE THIRD KIND

Most sci-fi films keep everything in sharp focus to wow you with effects, but Steven Spielberg used a more impressionistic style in this 1977 ordinary-guy-meets-the-aliens saga. The backgrounds are often blurred—check out the power-plant scene—and yet they translate beautifully in hi-def. The Blu-ray release has three versions of the film: the original theatrical release, an effects-boosted special edition and the director's cut.

THE THIRD MAN

If you think only color pictures can benefit from hi-def treatment, think again: This latest version of Carol Reed's 1949 film is breathtaking. Check out the extraordinary detail in the shots of Vienna's Riesenrad Ferris wheel, where Joseph Cotten's hero Holly Martins confronts seductive villain Harry Lime (Orson Welles).

LOOK FOR: The film's silvery, lustrous feel, which comes from the highly flammable nitrate film it was shot on. "With block-and-white transfers, you want to keep that luminous quality," Kline says.



2001: A SPACE ODYSSEY

Stanley Kubrick's 1968 epic offers a stunning array of visual and aural environments, from "The Dawn of Man" sequence to astronaut Dr. Dave Bowman's eerie bedroom. HD can't replicate the original 70 mm film (yet), but this Blu-ray still rates as home theater's ultimate trip.

THE WILD BUNCH

The HD transfer of Sam Peckinpah's galvanic 1969 film captures all the grit and gorgeousness of the West in exquisite detail—your mouth almost gets dry from all the dust the horses kick up. The quick cuts, shifts from regular to slow motion and spurting blood of the film's finale—one of cinema's most virtuosic gun battles—are rendered with a celluloid-like solidity. A less accomplished transfer would have given the viewer motion sickness.





NO COUNTRY FOR OLD MEN

The devil is in the details of this 2007 adaptation of Cormac McCarthy's novel. The opening shots of a depopulated desert, the murder-scene scuff marks on a police station's linoleum floor and every weird strand in murderer Anton Chigurh's haircut are staggeringly vivid. Composer Carter Burwell's eerie, insinuating soundscapes—often just the soft desert wind—are reproduced beautifully here as well.

BLADE RUNNER

This pristine digital rendering of Ridley Scott's groundbreaking sci-fi thriller, which follows a world-weary police specialist who tracks and eliminates a group of genetically manufactured replicants, corrects a couple of long-cited gaffes—it's now actress Joanna Cassidy, not a stuntman in a wig, who gets taken down by Harrison Ford—and adds polish to the special effects without compromising the movie's noir tones. If you had to name one disc that would justify the Blu-ray format, this is it.

LOOK FOR: Film grain that moves. A good transfer, Kline says, will smooth grain, not eliminate it completely. In lozy transfers, grain is static and looks more like pixels or gauze.



SHINE A LIGHT

Martin Scorsese's 2008 chronicle of an intimate New York performance by the Rolling Stones flexes all the muscles of your home theater. Viewers can count the multiple lines on axman Keith Richards's face and discern the gauge of his strings; the incredible surround sound pops, particularly during a jam with blues legend Buddy Guy.

THE LAST EMPEROR

Director Bernardo Bertolucci's films are known for their colorful visual style, and this sweeping but surprisingly poetic epic of modern Chinese history has been given one of the most gorgeous hi-def renditions ever by cinematographer Vittorio Storaro. On earlier VHS and DVD releases, the colors of Beijing's Forbidden City wavered like mad.

LOOK FOR: More accurate colors. Some, such as reds and blues, are hard to reproduce in the video world. But according to Kline, hi-def hues are getting closer to real-life shades thanks to a wider color space, which allows for more saturation and accuracy.



WALL-E

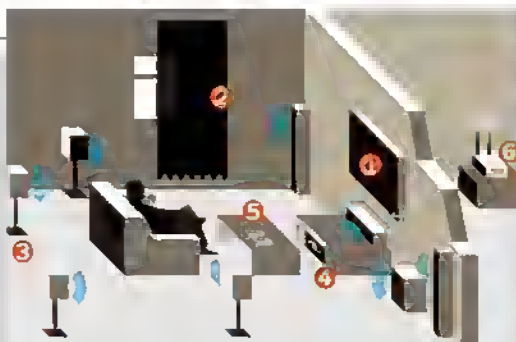
This hi-def disc of Pixar's imaginative film—about a trash-compaction robot who leads humans back to Earth after 700 years in space—is almost indistinguishable from the theatrical version. Expert digital compression has rendered details without distortion, revealing Wall-E's futuristic Earth covered in ironic trash.



Building Your Personal Cinema

Don't treat your movies like ordinary TV—give them a theatrical release.

By Joe P. Hasler



Screen

For maximum movie performance, a TV that can handle deep blacks, like the 50-in. **Pioneer Kuro** (\$4000), which has an off-the-charts contrast ratio, is worth the money. But don't mount it high like a painting—it should be at eye level when you're sitting on a couch (1). Then move the couch to the ideal viewing distance, which is 1.9 times the width of your set. Also, buy dark curtains—direct sunlight washes out even the finest HD picture (2).

Sound

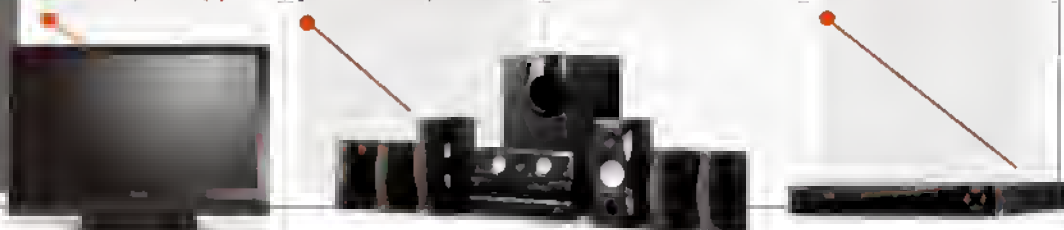
Experts say that you'll never tell the difference between 5.1- and 7.1-channel surround sound in small spaces. In a large room, however, the extra speakers help (3). Not every Blu-ray disc is recorded with a full 7.1-channel soundtrack, but the format supports it. As discs evolve toward 7.1 sound, an affordable all-in-one home theater such as the **Onkyo HT-S5100** (\$380) can seem like a future-proof bargain if you have the space for it.

Environment

When designing a home theater, it's best to hide components and their blinking lights inside cabinets or closets, but make sure the space is well-ventilated (4). Components need room to breathe, or they can overheat and fail. And while remote controls may clutter your coffee table, home-theater installation expert Tony Yoo advises against a universal remote (5). "Programming six remotes into one system is often more hassle than it's worth."

Player

Unlike DVD players, new HD players are Internet-enabled, so make sure you have network access available to your components (6). Wire up an Ethernet cable to the **Samsung BD-P2500** Blu-ray player (\$400) or the Microsoft Xbox 360 console, and you can stream Netflix movies on demand. Other devices such as AppleTV, Sony's PlayStation 3 and Vudu can link to Wi-Fi so you can rent HD movies over the Internet.



did it in postproduction, duplicating each frame three times with an optical printer. Every single frame—the original and the three dupes—and its imperfections must be dealt with individually. There are automated methods of cleaning up digital transfers, after which technicians can assess the results and backtrack in case of error. But *Express* is getting an exclusively human touch, with hands-on techs making all the decisions on what stays, what goes and what replaces what goes. And that's just the visuals: In another part of the facility, an audio technician goes through the film's soundtrack, using Pro Tools and other software to remove extraneous pops and other forms of sonic distortion. The cleanup of the 1-hour 42-minute film will take 480 hours.

But as glorious as HD film restorations can be, they can also be disastrous. Scorsese's *The Color of Money* is arguably an improved product over even its theatrical release, because it was remastered with care and atten-

tion. But the Blu-ray of *Gangs of New York*, produced without the participation of Scorsese or Schoonmaker, is a sloppy mess. In the opening scene, as Liam Neeson's gang marches through its underground headquarters preparing for a turf war, the flames of the torches and candles illuminating the scene look like cartoons. Skin tones are often orange, and the visuals are made all the more surreal by edge-enhancement techniques that give the characters full-body halos.

Two movies by the same director, two totally different results. The lesson is that in a hi-def world details matter, because all the details are visible. On DVDs and VHS tapes, moviemakers didn't have to concern themselves with whether or not to smooth out film grain, because you couldn't see it. With HD, you see everything.

Archivist Robert Harris knows a thing or two about film grain. One of his most ambitious projects to date is a restoration of the *Godfather* trilogy. The Blu-ray

Download vs. Disc

PM tests for the best hi-def.

Resolution

Bit Rate

File Size

Audio

Cost

Test Results

BLU-RAY



1920 x 1080 pixels

Up to 40 Mbps

Up to 50 GB

5.1 or 7.1 channel

\$20-\$30 (purchase)

DOWNLOAD



APPLE TV

VUDU

1280 x 720 pixels

Not disclosed

Not disclosed

5.1 channel

\$4-\$5 (rental only)

1920 x 1080 pixels

4 Mbps (Instant HD); up to 20 Mbps (HDX)

2.5 GB (Instant HD); 6.5 GB (HDX)

5.1 channel

\$4-\$6 (rental only)

We showed our test audience several hi-def clips of the same movies from Blu-ray discs and downloaded files from Internet rental services Vudu and Apple TV. Our audience was asked to pick which had the highest fidelity video.

On the 2008 film *Speed Racer*, 70 percent of our testers identified the Blu-ray disc as the best HD source material. Vudu's HDX format was ranked second, and AppleTV's HD format was ranked last. Respondents claimed AppleTV's video was "softer" and not as detailed, while Blu-ray had far more clarity in darker areas.

With the HD transfer of *Close Encounters of the Third Kind*, however, the difference was not as pronounced. Viewers were split between the Vudu HDX and Blu-ray formats as the best.

lined up," Harris says. "Color is cranked. Contrast is cranked. They're running images of clown fish swimming in coral. It's the clown fish that sell the HD sets. When the buyers get home, if they see *Bullitt* or *The Sting* in hi-def with grain on it, they say, 'That's horrible.' They don't know it's not video noise. They don't know that what they're watching is the film."

Directors and cinematographers may debate endlessly about the purity of HD film transfer, but John Lowry, founder and chief technology officer of Lowry Digital, is in the business of delivering what his clients want. If they want to retain film grain, as Steven Spielberg and George Lucas did when they brought the first three *Indiana Jones* films to him, he keeps the grain. But if the client requests a grain-free image, the grain must go.

For example, Lowry Digital did the restoration for Disney Home Video's first Blu-ray disc of a classic animated title, 1959's *Sleeping Beauty*. Hand-drawn animation movies don't benefit from the film fidelity that gives *The Godfather* its visual style. Instead, the aim of restoring an animated movie is to remove the influence of film and

get to the essence of the illustrated artwork underneath.

By any measure, the transfer of *Sleeping Beauty* was an epic job. Lowry had access to the original negative from the Disney archives. The film was originally shot in the Vista Vision format, in which a single frame is the size of two 35 mm frames. The negative was also in what is called sequential color—first frame red, second green, third blue. Since each frame of film produced three scans, that meant three times the restoration work. As a result, the digital restoration of the film took eight months instead of the typical six. "You scan that kind of material carefully and you get incredible results," Lowry says. "Beautiful color. Excellent resolution. And what little grain there is can be cleaned up, along with dirt and scratches, to create the ideal version of what the designers, animators and colorists intended."

Lowry is a master of the digital magic that Thelma Schoonmaker used to change those blue pool tables in *The Color of Money* to green. The technology can do even more elaborate tricks. In restoring *Raiders of the Lost Ark*, Steven Spielberg was finally able to correct one of that film's most famous gaffes—the reflections on the pane of glass that separates Harrison Ford from a room full of snakes in one of the film's most memorable scenes. Likewise, director Terry Gilliam was able to erase wires holding up the flying characters in *The Adventures of Baron Munchausen* for its Blu-ray release.

transfer of Francis Ford Coppola's mob epic—consisting of two masterpieces made in 1972 and 1974 and a less well-regarded picture made in 1990—look nearly two years, with considerable input from Coppola and cinematographer Gordon Willis (who shot all three films). The project raises a question: Just how much tinkering does a classic film need?

Harris has a simple answer, a mantra provided by the exacting Willis: "The film is already there. Our job is to reproduce it." And that means, among other things, reproducing film grain—which often gets "cleaned up" via digital noise reduction. For the *Godfather* films, Harris says, "We didn't touch the grain, except to equalize it where we were dealing with [mylar editing] tape over frames. But *The Godfather* is a grainy film. So is *Part II*. They were shot in a very specific way." Harris points to *The Godfather*'s opening wedding sequence as an example. The scene was purposefully overexposed and made to look as if it were shot on mid-1940s film stock, with blown-out colors and lots of grain. "That is *The Godfather*," Harris says. "If you take it away, it's no longer *The Godfather*. It turns into a movie of the week."

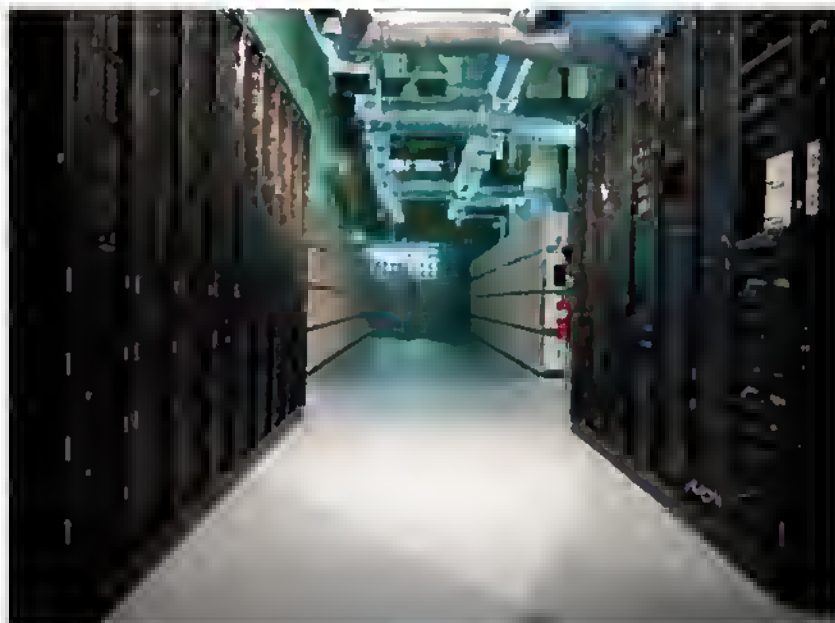
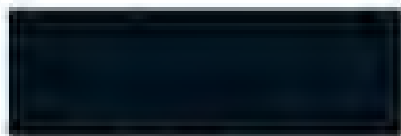
Clarity and precision are at the heart of the HD digital video medium. Consumers expect knock-your-socks-off brightness, color and detail, which means that a faithfully reproduced cinematic image can seem flawed. "You walk into the big-box stores, and they've got all these monitors

THE BIG SQUEEZE

WITH CONTEMPORARY FILMS, THERE IS NO NEED to clean scratches, film grain and dirt for a hi-def home release because there's nothing to clean up. "On modern movie titles, the HD masters are part of the [original] production process," notes Grover Crisp, senior vice president of restoration and digital mastering for Sony Pictures Entertainment. Studios and filmmakers increasingly use "digital intermediates" to color-correct and otherwise tweak films prior to their release. So studios have a digital version of a film in place before it hits theaters, which explains why contemporary films often look so stunning on high-definition discs. Of course, movies that are shot or animated digitally require no "transfer," since they never leave the digital domain at all. Pixar, for instance, creates all its movies—from *Toy Story* to *Wall-E*—as huge digital files. Preparing them for a home release requires only that they be compressed to fit the HD media.

Compression, though, introduces a whole new set of technical challenges. This process squeezes down the size of a film's digital file by applying an algorithm that trims redundant picture information, hopefully with minimal distortion. Despite marketing claims to the contrary, there is no such a thing as "lossless" digital compression. Most video compression is "lossy"—that is, it loses information that the eye presumably can't discern. The algorithms are incredibly flexible,

Lowry Digital (below), in Burbank, Calif., uses hundreds of ultra-high-speed image-processing machines and 700 terabytes of storage in its digital movie restoration and production facility.



and there is no standard for hi-def compression. Consider, for instance, that the uncompressed digital master of a typical Hollywood movie requires 5 to 15 terabytes of storage space. To fit it onto a Blu-ray disc, it is compressed by 100 times or more to 50 gigabytes. For distribution over an HD rental download service, it is reduced to 6 gigabytes or less. Yet all of these versions of the same movie are considered hi-def.

To save space, mastering engineers get creative. One trick is to apply a lot of compression to dark backgrounds—thereby reducing the bit rate (the amount of video data presented each second). But too much compression can create blacks that look like dark clumps instead of a natural part of the overall picture. Picture information with a lot of motion in it, such as flickering flames, needs to be handled carefully in compression, lest the result be a bleary, unrealistic rendition.

To companies such as Disney and Pixar, compression is itself an art form. "We work with compression artists and try to get the highest bit rate to make the best experience," says Sara Duran-Singer, Disney's vice president of worldwide postproduction. "In the case of the Pixar titles, the filmmakers approve it. They know quite well how each part of the film is going to compress."

Digital technology also has the potential to change the way we watch films. Many of the Blu-ray players on the market can connect to the Internet via the BD-Live feature, and digital-movie download devices such as Apple TV, Vudu and the Microsoft Xbox 360 are networked by design. That opens up options for home movie watching that are impossible in a public theater, such as editing and sharing your own film sequence—as you can on the Blu-ray version of director Paul W.S. Anderson's *Death Race*—or allowing viewers to instant-message each other onscreen as they watch, as kids can do on *Sleeping Beauty*.

Isn't there some irony in providing potentially disruptive extra features to such a painstaking restoration? Possibly, says Lori MacPherson, Disney Home Entertainment's general manager for North America. But she notes, "These are extras you can opt into. They're not pushed at you if you just want to watch the movie."


Imagine that: sitting back and watching the movie. Cinema purists and new-media technophiles will argue whether interactivity has a place in the movie-watching experience, but such is the dual nature of the new home-theater technology. You can bend the movie to your creative will, but you can also surrender to it, forget yourself for a while, become a guest of the Godfather at his daughter's wedding—all from the comfort of your home. It's an offer you can't refuse.

PM



HEAVY LIFTERS

THE FULL-SIZE PICKUP IS AN ESSENTIAL TOOL WHEN WE TACKLE THE BIG JOBS—THE ONES ONLY A 6-FT BED OF STEEL CAN HANDLE. WE PUT THE FIVE NEW HALF-TONS TO THE TEST.

 The automotive world is downsizing. Concerns about fuel costs, the environment and the weak economy have forced automakers to shrink both the size of vehicles and sales expectations. Big, thirsty and, yes, profitable vehicles just aren't moving off dealer lots the way they used to. So it's no surprise that full-size pickups are feeling the heat. That's tough news for Motown, and for every other town in the U.S. that builds pickup trucks.

Despite this downturn, the market for full-size pickups is still massive. This year, about 2 million of them will enter service across the country. Americans still need

these workhorses to do the dirty, laborious tasks that only a pickup can handle. We still tow boats, we still carry tools to the job site, and we most certainly still need a pickup bed to haul lumber and Sheetrock for our home-improvement projects.

The good news is, today's pickups are the most capable, fuel-efficient and useful trucks ever built. We know because we gathered five pickups from Chevy, Dodge, Ford, Nissan and Toyota for a full-size showdown in the town where pickup trucks were invented—Detroit. Dodge and Ford have rolled out redesigned entries for 2009, so the timing was right for a comparison of the new and established players. We requested four-wheel-drive crew-cab models because they make up about half of the light-duty, full-size market. We ran them hard, measuring acceleration and braking both unloaded and with 966 pounds in the bed. We evaluated handling and real-world fuel economy too. We also hitched a 7560-pound, 22-ft-long enclosed car hauler to the trucks to gauge how each one behaves when towing.

Since these pickups all have generous rear seats, we spent time evaluating those perches, and, of course, got friendly with the various onboard electronic systems. In the end, we learned that all of these trucks are capable work machines. The hardest part? Picking the winner.

We spent a week testing the latest full-size trucks, lined up at left in formation at a former hood- and door-stamping factory in Detroit, to find out which was best for work and play.

BY LARRY WEBSTER

Photographs by
FRANK W. OCKENFELS 3

FIRST PLACE

Ford F-150 4x4 Supercrew Lariat

Ford's best-selling full-size pickup has gone through a stem-to-stern re-engineering for 2009. The result? This truck, the best in our bunch, handles the tasks pickups are built for—real work.

Ford is simply the better truck. Its tow rating, a stout 11,200 pounds, handled our test trailer with ease. It shares the electronic trailer sway control feature with the Dodge, but only the Ford has an integrated brake controller. And that's a game-changing feature. The Ford was the only truck to offer a flat load floor under the rear seat. This makes the space more useful for real hauling than the lumpy bottoms of the other trucks. Ford is the only one with a system that can electronically track your tools—that's cool. And ours came with Microsoft's Sync entertainment and communication system and a gorgeous bird's-eye-view navigation system, both of which are simply class-leading. It was these details, the Ford's nearly one-pickup-class-above work capability and overall refinement that tipped the scales.

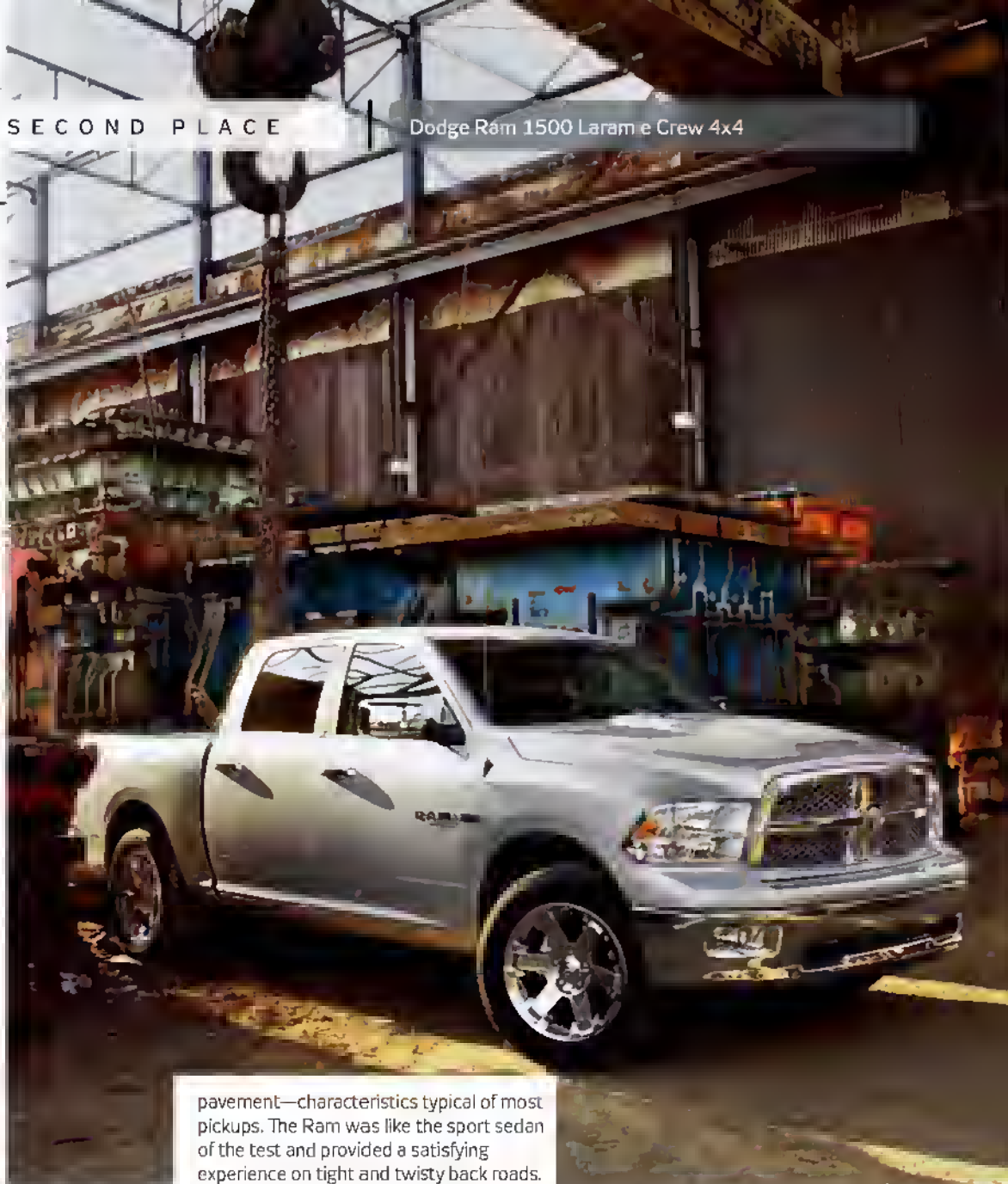
Ford has made incredible strides in refinement and capability with the new F-150. It may look like a more chiseled version of the old truck, but from behind the wheel, it is a much improved beast. It's as though Ford gave every nut and bolt an extra half-twist of torque to make sure the F-150 is drum-tight. The F-150 is the heaviest here, a porky 5921 pounds. And despite the newly empowered 5.4-liter V8, that weight hurts acceleration and handling. It was the slowest and required the longest distances to come to rest.

But trucks don't live on the test track, and the F-150's weight has been put to use. The Lariat has a wonderfully rigid body, which quells vibration and makes for a serene interior. At 60 mph, the Ford was the most hushed of our group. The longest truck here, our F-150's rear seat also offered the most volume. When the roads turned serpentine, the Ford's excess weight was noticeable. It wasn't quite as tossable or fun as the Dodge—but the ride quality was close to that benchmark. For work, we found that the

SECOND PLACE

Dodge Ram 1500 Laramie Crew 4x4

If this were a design competition, the Ram would grab the top prize. Our test team unanimously voted this Dodge the most stylish of our quintet. The forward-canted grill and headlights are just plain tough.



pavement—characteristics typical of most pickups. The Ram was like the sport sedan of the test and provided a satisfying experience on tight and twisty back roads.

The leaf spring may date back to the horse and buggy, but it is still the industry standard for pickup-truck rear suspensions. Like a hammer, hacksaw or shovel, leaf springs are simple and effective. But these springs equate to a rougher ride than other systems. So Dodge ditched this old tech and engineered the new Ram with a coil-link rear suspension. The coil-link design is a dynamically superior way to control a solid axle. And coils offer a smoother ride—this Dodge was the cushiest of the bunch. Better still, we never once felt the rear end dancing around on washboard dirt roads or deeply potholed

But there's more to this truck than springs and shocks. The interior of our nearly 50-grand Laramie was downright swanky. The stitched leather coverings and handsome layout were fit for a German sedan. The shifter resembles a ram's head and was the most comfortable to use.

The seats weren't the roomiest, but they were the most comfortable in this test, with raised seat cushions and a relaxed backrest tilt. The Dodge is not engineered solely for comfort. There are handy insulated storage bins in the floor. And you can opt for the new RamBox, which adds lockable storage to the bed, albeit at the expense of some hauling space.

The 390-hp Hemi V8 and five-speed

automatic provided a satisfying combination of grunt and refinement. It must be said, too, that the Ram had the coolest exhaust treatment: dual pipes, straight out the back like a muscle car. We all fought for the keys to drive this Ram home each night. So why no gold medal? The so-so 6800-pound tow rating, high price tag and fewer available work-oriented capabilities than the Ford kept the Dodge from becoming the Michael Phelps of our group. However, without revealing secret PM deliberations, we can say the voting was one hanging chad away from a tie.



The Titan won our two previous full-size-pickup comparison tests outright. That impressive track record meant we set a higher bar for this truck than for any of the others. Our test scores ranked only the all-new Dodge and Ford higher than the nearly 5-year-old Nissan design—that speaks to the impressive engineering baked into this truck. You sit high in the Titan, which gives the driver a three-quarter-scale big-rig experience—the visibility is excellent. Nissan equips the Titan with only one engine option, but it's a good one. The 5.6-liter V8 backs up the Titan's macho persona with robust acceleration and an NHRA-quality exhaust note. But all that gusto rests on a hair trigger. The throttle is just too touchy, causing jack-rabbit launches. Yet once underway, the power built with more linearity. The five-speed shifted promptly and smoothly.

The ride was rough at times, due in part to the firm Rancho shocks. Still, the body and frame felt more resistant to twist than the Chevy's. While the Titan wasn't as crisp in the corners as some—

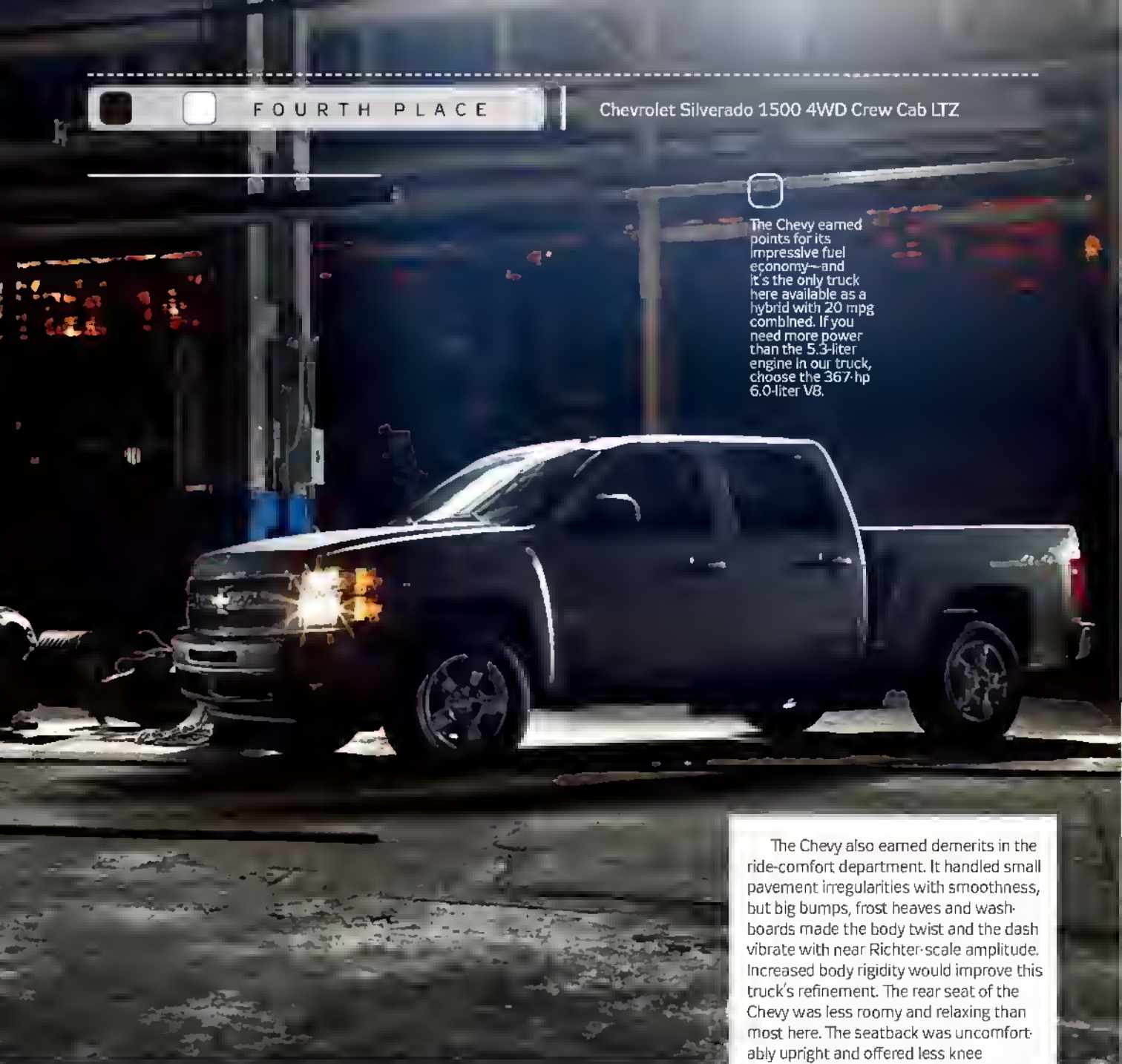
thanks to those off-road biased tires—it still felt light on its feet and, dare we say, fun to push hard.

Inside, the front leather seats are supple thrones and were the only chairs with inner armrests—unanimously appreciated by testers. The back seat has competitive levels of legroom; the upright backrest, however, made it one of the less comfortable in the test. At a tick under 41 grand, the Titan is the least expensive here. It doesn't have a stability control system, a feature included in all the others. However, the Pro-4x package meant our Titan was the only truck with an electronically locking rear differential. Nissan will remake the Titan within the next couple of years. The plan? A Nissan version of the Dodge Ram. That sounds like a good formula to us.



Gear hauling is easy business in the Nissan Titan. Our Pro-4x came with a spray-in bed liner and movable load-management tie-down cleats. It's one of the handiest systems on the market for securing cumbersome loads.





The Chevy earned points for its impressive fuel economy—and it's the only truck here available as a hybrid with 20 mpg combined. If you need more power than the 5.3-liter engine in our truck, choose the 367-hp 6.0-liter V8.

The Chevy also earned demerits in the ride-comfort department. It handled small pavement irregularities with smoothness, but big bumps, frost heaves and washboards made the body twist and the dash vibrate with near Richter-scale amplitude. Increased body rigidity would improve this truck's refinement. The rear seat of the Chevy was less roomy and relaxing than most here. The seatback was uncomfortably upright and offered less knee clearance. From the captain's chair, looking out over the smoothly flowing dash and convincing wood grain, the Chevy's cockpit is fit for an upscale sedan. Trouble is, this is a truck test. There just didn't seem to be much creativity in the various cubby designs compared to the Ford or Dodge. That said, Chevy does offer a no-cost, optional "Pure Pickup" interior in other trim levels that is more suited to work duty. The Chevy came with plenty of goodies, including rear-seat entertainment and navigation systems. The Silverado is still a capable, competent pickup truck, but nowadays that's just not enough.

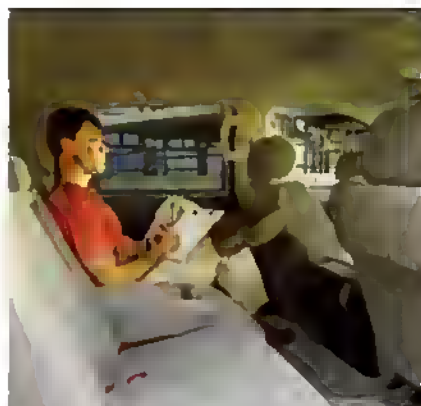
The highly competitive pickup business moves quickly. The Chevy, which was such hot stuff when it launched two years ago, only made it to fourth in this roundup. There is, however, much to like. The Silverado handled superbly, exhibiting crisp turn-in response and a decidedly untrucklike neutral handling balance. It was quickest through both the lane-change and slalom tests.

The Silverado's 5.3-liter V8 was the smallest motor of the group, but the truck did not feel underpowered. Thanks in part to the cylinder deactivation system, the Chevy had the highest EPA highway rating (20 mpg) and scored the second-best real-world economy in our test. The close ratio spacing in the new six-speed transmission and street-oriented rubber might have given the Silverado a bump there. Under light load, the automatic swapped gears with luxury-car smoothness. But when tasked with real work, the shifts became surprisingly harsh, especially when we had the trailer attached, and the gearbox had to drop down two gears to make a pass.



SPECIFICATIONS & TEST DATA

	FORD F-150 4x4 Supercrew Lariat	DODGE RAM 1500 Laramie Crew 4x4	NISSAN TITAN 4x4 Pro 4x	CHEVROLET SILVERADO 1500 4WD Crew Cab LTZ	TOYOTA TUNDRA 4x4 Crewmax SR5
Base price	\$37,990	\$43,240	\$35,880	\$40,075	\$33,985
As tested	\$45,610	\$49,460	\$40,785	\$46,940	\$41,820
Powertrain	320 hp/390 lb-ft 5.4-liter V8, 6A	390 hp/407 lb-ft 5.7-liter V8, 5A	317 hp/385 lb-ft 5.6-liter V8, 5A	320 hp/340 lb-ft 5.3-liter V8, 6A	381 hp/401 lb-ft 5.7-liter V8, 6A
Suspension (f/r)	Independent coil springs/live axle, leaf springs	Independent coil springs/live axle, coil springs	Independent coil springs/live axle, leaf springs	Independent coil springs/live axle, leaf springs	Independent coil springs/live axle, leaf springs
Wheelbase (in.)	144.5	140.5	139.8	143.5	145.7
Length (in.)	231.7	229.0	224.6	230.0	228.7
Width (in.)	78.9	79.4	79.5	79.9	79.9
Track (f/r)	67.0/67.0	68.2/67.5	67.9/67.9	68.1/67.0	67.9/67.9
Axle ratio	3.73:1	3.55:1	3.36:1	3.42:1	4.30:1
Brakes (f/r)	13.00-in. disc/ 13.70-in. disc, ABS	13.20-in. disc/ 13.80-in. disc, ABS	13.80-in. disc/ 12.60-in. disc, ABS	13.00-in. disc/ 13.50-in. disc, ABS	13.90-in. disc/ 13.60-in. disc, ABS
Curb weight	5921	5622	5472	5496	5838
GVW	7200	6800	7200	7000	7200
Payload (GVW-curb)	1279	1178	1728	1504	1362
Towing capacity	11,200	6800	9400	9500	10,100
Tires (f/r)	P275/65TR-18	P275/60SR-20	P275/70TR-18	P265/65R-18	P275/65TR-18
Acceleration (sec)					
0-30 mph	2.98	3.28	2.91	3.32	2.68
0-60 mph	8.61	8.23	7.57	8.47	7.01
40-70 mph	6.54	5.92	5.97	6.57	5.27
Quarter-mile	16.20@85.62 mph	15.92@89.77 mph	15.67@88.07 mph	16.37@86.35 mph	15.18@91.02 mph
Acceleration (sec, loaded)					
0-30 mph	3.11	3.45	3.02	3.52	2.86
0-60 mph	9.33	8.98	8.31	9.38	7.84
40-70 mph	7.36	6.89	6.80	7.44	6.04
Quarter-mile	16.84@82.85 mph	16.56@85.87 mph	16.24@84.15 mph	17.01@82.60 mph	15.82@87.89 mph
Braking (ft)					
30-0 mph	34.75	30.44	32.02	31.95	33.49
60-0 mph	140.8	123.09	130.56	134.00	137.76
Braking (ft, loaded)					
30-0 mph	33.73	30.60	31.16	32.51	31.89
60-0 mph	141.33	126.89	128.30	136.34	137.94
Sound levels (dBA)					
Idle	60	61	61	60	60
Full throttle 60 mph	79 68	78 72	77 72	82 71.5	81 70
Slalom (mph)	34.92	34.65	34.49	35.09	34.22
Lane change (mph)	49.12	48.98	48.84	49.99	47.75
Skidpad (g's)	0.69	0.72	0.71	0.70	0.67
EPA fuel economy (city/hwy)	14/18	13/18	12/17	14/20	13/17
FMI fuel economy (mpg)	17.34	16.79	14.66	17.44	17.69



ROOM TO MOVE

Today's pickup trucks need to haul people as effectively as they haul dirt bikes and drywall. So four-door models are locked in a heated battle for legroom. That title belongs to the Tundra (left). It offered the most rear legroom, 44.5 in. The F-150 was a close second at 43.5 in., but we found the Ford's seat cushion a bit too low. Legroom as a singular specification is not enough to guarantee comfort for all. We'd give up an inch or two of knee clearance for the Ram's superlative seats—the Dodge had the most comfortable ones, plus 42 in. of legroom. —L.W.



Underneath the Toyota Tundra's metal is a robust drivetrain that in some cases is one class up in overall strength. The rear axles on 5.7-liter trucks have a mammoth 10.5-in. ring gear in the rear differential.



If connecting with your inner drag racer and hauling a load as quickly and as fuel-efficiently as possible are prime objectives, then Toyota's monster-motored Tundra is the proper tool. With 381 hp on tap, it was the quickest to 60 mph, hitting the mark in 7.01 seconds. And the Tundra barely noticed the weight we put in the bed—it was quicker with that load on board in the 0-to-60 test than every truck unladen except the Nissan. This beast really hauled, but when the steering wheel was turned, it felt brutish. The Dodge and Chevy felt small and nimble around town, but the Tundra was a bit clumsy, its moves ham-fisted. In handling tests, the stability-control system intervened early and rudely. And while the system can be shut off, it cannot be completely defeated.

The Tundra also drew negative marks for its budget-class interior. While there are plenty of useful storage bins and a huge center console, the dash and door panels are a sea of hard plastic fit for an economy car. The stretch from the front seat to the dash

controls requires an NBA player's wingspan. That said, if you plan on taking Shaq and Kobe along with you, their long legs will be most comfortable in the Tundra's back seat.

The Tundra towed our trailer with commendable verve, and it had the second highest as-tested tow rating (10,100 pounds). The Toyota delivered the best fuel economy over our 220-mile test, quite a feat considering it has 381 hp and the second highest weight. As a tool, the Tundra is hard to criticize. But it just isn't as well-rounded as the others—it lacks refinement. And we want more than an appliance for our \$41,820.

WHO'S

TRACKING

YOU?

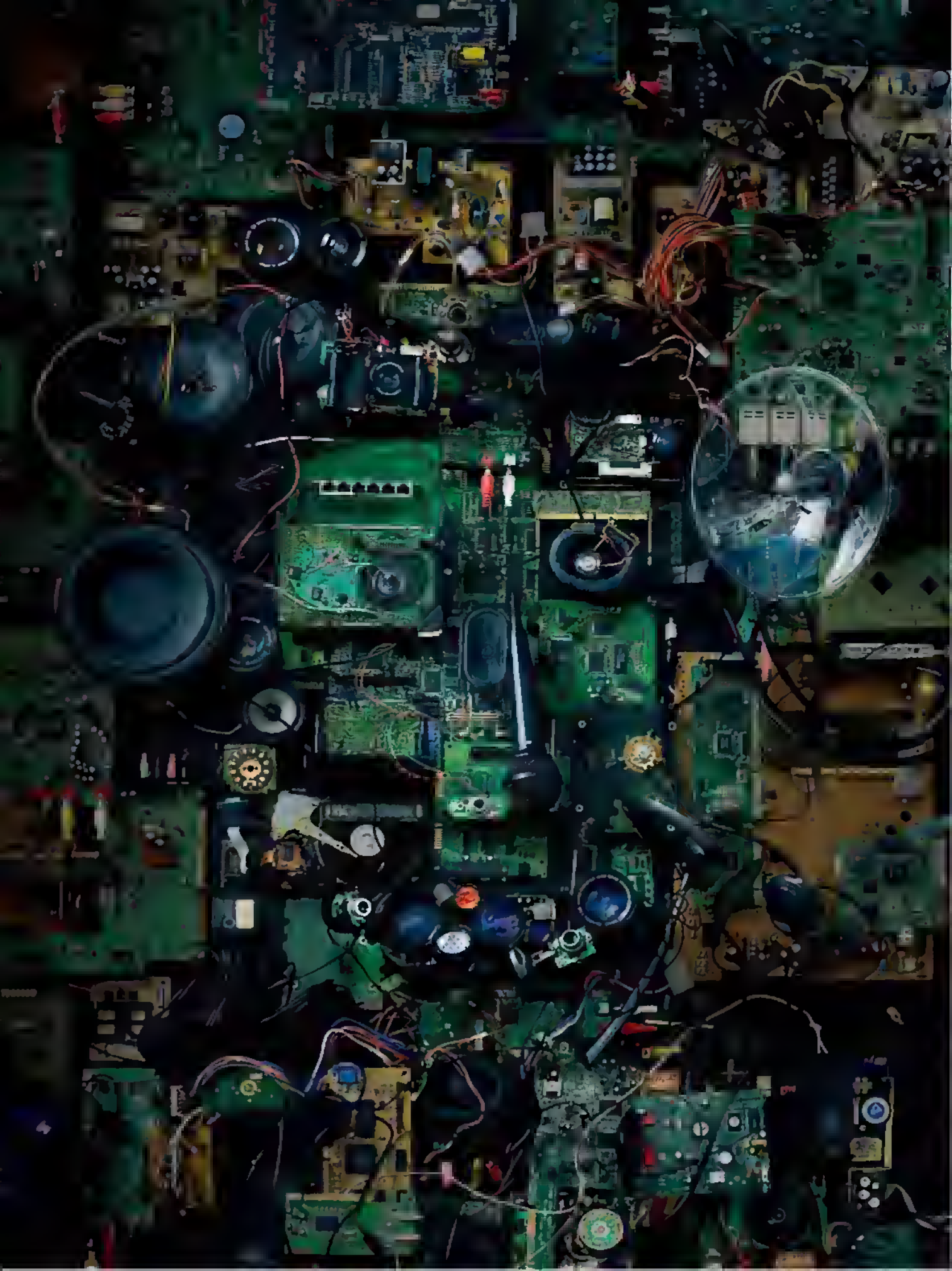
THE DIGITAL DEVICES YOU USE TO ORGANIZE YOUR LIFE ARE KEEPING VERY DETAILED NOTES. IS PERSONAL TECHNOLOGY WORTH ITS COST IN PERSONAL PRIVACY?

BY BRIAN KREBS

MARISEL GARCIA FIRST SUSPECTED something was amiss with her laptop when she noticed that the tiny activity light above the built-in camera flickered whenever she was in front of it. The Hialeah, Fla., resident also thought the PC's battery was draining faster than normal. When she brought her laptop to a friend who worked in technology, he found that someone had installed software that allowed the computer to be controlled remotely. What's worse, that person had been taking photos through her webcam.

Investigators say the spyware was created and installed by Craig Matthew Feigin, a 23-year-old student at the University of Florida who had previously offered to fix a problem with Garcia's computer. Police arrested Feigin, who now faces a federal charge for computer tampering, to which he has pleaded not guilty. In his statement to police, Feigin described how he had configured the software to take snapshots of anyone who moved in front of the webcam. He eventually amassed more than 20,000 images of Garcia, her

PHOTOGRAPH BY HOLLY LINDEM



boyfriend and other friends, and sent snapshots of their most private moments over the Internet to contacts in Eastern Europe. Considered tech-savvy around campus, Feigin was often approached by students who needed help with their computers, and Gareia was in town visiting friends when she asked for his help to make her PC run faster. He admitted to investigators that he had installed the same software on PCs belonging to more than half a dozen other women.

According to court records, Garcia used her laptop the way many people do today—as a communications link that's always online and carried from room to room for e-mailing, instant messaging and shopping. This type of open digital pipeline connecting private space and the public Internet is swiftly becoming the norm in America. According to the Pew Internet and American Life Project, more than half of the adult population in America now use broadband Internet. Plus, almost 30 percent of Americans have 3G-capable phones. These are the twin pillars of our digitally connected modern society: High-speed DSL and cable broadband connections have transformed the way people use the Internet at home, while 3G cellular networks have allowed us to take that digital connection on the road.

As these powerful networks have evolved, so have the devices we use to access them. Personal computers, once self-contained processing machines, have become permanently connected devices. Most software also requires an Internet link to work properly; in fact, the latest trend in “cloud computing” moves software off the computer altogether. The evolution in cellphones has been even more dramatic. These were once analog devices designed exclusively for making phone calls; now they are data-centric mini-computers with integrated satellite-tracking capability. With each new gadget we buy and use, we make a choice to further integrate our lives into the public Internet. That decision has enormous implications for our conventional understanding of privacy and personal space.

Our digital tools provide an open window to our lives, and a long list of curious characters—hacker peeping Toms, corporate marketers, jealous jilted lovers, snooping government agencies—are eager to look inside. And the digital portrait they see is more detailed than ever. According to market research firm IDC, the average person has an online digital presence of 45 GB—about half of which is created by outside sources. This digital shadow of our lives is colored in with e-mails, photo posts, password hints, Facebook friend requests and location-based queries flowing fluidly in and out of the electronic devices we bring with us everywhere.

Mobile Positioning System

CELLULAR PHONES ARE THE MOST ubiquitous location-aware devices on the planet. Their very operation depends on knowing where the user is. Any phone can determine its own location (and thus the location of the user) by triangulating from multiple cell towers, then send that information back to the wireless service provider. This capability makes it possible to route calls efficiently to subscribers, and it can often save lives. In 1996, the Federal Communications Commission mandated that cellular providers phase in location-aware Enhanced 911 (E911) capabilities on most cellphones by

Webcams

“Webcams are only as secure as the computer they’re connected to,” says computer security expert John Pironti of Getronics, “and many computers aren’t very secure.” Plenty of software exists in the hacker community and even on the open market that can allow stalkers and other miscreants to remotely control your computer. According to the Internet-security watchdog group Shadowserver, more than 1.5 million computers are currently hijacked without the knowledge of their owners. If a hacker has root-level access to your computer, he can monitor or control any peripheral gear, from your iPod to your webcam to your printer.

How to Fight Back

The usual computer safety advice applies. Make sure you have up-to-date antivirus and antispyware software. Plus, make sure your firewall is turned on (check your operating system’s security settings). Pay attention to your computer: If peripherals turn on randomly, do a spyware scan immediately. And if you are concerned about a digital peeping Tom, remember, even the most sophisticated webcam hijacker can’t see through a piece of black tape.

2012 to determine the position of a caller in an emergency to within 300 ft. Just last June, two hikers who wandered off course in Alaska’s Denali National Park were found a few days later when rescue workers tracked them through their cellphones.

Many newer phones are shipping with embedded GPS antennas, giving them location and mapping capabilities that rival embedded navigation



Twenty-three-year-old student Craig Matthew Feigin was arrested in Gainesville, Fla., for hijacking the webcams of several women. He secretly took more than 20,000 pictures of one victim.

systems in ears. But since phones are two-way communications systems, they are open to a variety of uses beyond E911 and simple navigation.

Many companies are taking advantage of these capabilities to help manage time cards, monitor gas mileage and ensure that workers aren't slacking off. Gearworks, based in Eagan, Minn., provides location-tracking services to the transportation, infrastructure and healthcare industries. Phones outfitted by Gearworks operate like digital foremen for employees in the field. They can navigate an employee to a job site, record the amount of time it took to get there and perform the job, then allow him to remotely punch out when the job is done. According to company co-founder and chief technology officer Rob Juncker, devices using Gearworks location-tracking technology explicitly inform users that they are being tracked, and employees have the option of temporarily disabling the tracking feature for "privacy breaks."

Many emerging businesses are using the native tracking ability of modern cellphones to sell location-based information as a lifestyle service to consumers. Startup companies such as Loopt and Whrrl offer everything from real-time directions to information on local restaurants, movie showings and friends in the area. The trend toward location tracking is expected to become the future model for mobile advertising and marketing, serving up ads and special deals not only targeted at you personally, but relevant to where you are geographically.

Yet legal standards of privacy for use of your location data are inconsistent at best. "The law says that information can't be disclosed without prior opt-in from the consumer, but that law only applies to telecommunications carriers," says Jim Dempsey, vice president for public policy at the Center for Democracy & Technology. "But many entities handling location information, or with access to it, are not telecom carriers." A survey of the privacy policies of many location-based service providers shows how fluid the

Cellphones

Many newer cellphones come with built-in GPS antennas and have the capability to broadcast their location. Many smart phones can run hidden tracking software. This sends your location in real time and can allow

someone else to remotely read your text messages and call logs and even use your phone's microphone as a bug to hear your conversations.

New mobile social-networking services such as Loopt and Whrrl encourage users to share location data to get information about local restaurants and nearby friends, but those services also

reserve the right to share your location and personal info with their business partners.

Even a cellphone without a GPS antenna can be tracked by triangulating its location from cellphone towers. Although this capability was designed to help first responders locate 911 calls, it is routinely used by law-enforcement agencies to track suspects.

How to Fight Back

Treat your cellphone like your wallet, and don't give it to anyone you don't trust. Before signing up for any location-aware cell service, check the privacy policy closely to see how they use your information. When you don't want your location broadcast, go to your phone's menu and turn off location services—or better yet, turn off your phone altogether.

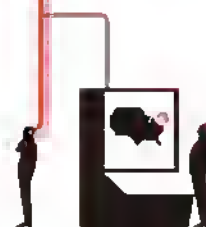
traffic in personal location data has become. Because many of these services are opt-in, once the user has agreed to the terms, his phone can be tracked even when the application is turned off. And the data collected, along with other personal information, can and will be shared with advertising and marketing partners—that is, in fact, the business strategy of these services.

A personalized marketing campaign offering discounts at the burger shop around the corner may seem relatively innocuous, but as more cellphone users embrace location-aware phones, their devices automatically create a worldwide web of evidence that can easily show up in court.

Albert Gidari, a partner with the Seattle offices of Perkins Coie, represents a number of wireless carriers. He has seen at least two civil suits so far in which companies have sought location data from providers. One of these cases, brought by a large insurance company, sought location data on a subscriber who was suspected of stealing and setting fire to his own car in order to recover the insurance payout.

Both cases were ultimately abandoned by the plaintiffs because of costs. But Gidari suspects the reason more cases don't involve requests for location data is that litigants simply aren't aware it's available. "What I think is on the horizon is that in every insurance case involving a distracted driver, someone's going to ask, 'Was the driver on the phone?' and 'Was the driver texting at the time of the crash?'"

The tracking technology in cellphones is exploited not just by businesses and the courts. An established market exists for consumer spyware programs that can be installed on cellphones. Dozens of Web sites advertise GPS tracking devices and stealth software, encouraging users to "catch a cheating spouse" or "keep a watchful eye on your children." A few hundred dollars can outfit suspicious or obsessed amateur detectives with an arsenal of spy gear. Some of these services let



Web Browsing

Web tracking is big business. Shopping sites, online publications, advertisers, search engines and government agencies all collect information about your surfing habits. The information-collection mechanism of choice for aggregating browsing info is the tracking cookie, a small, unique bit of code that identifies you when you visit a site. Some cookies are temporary, remaining on your computer only as long as your visit to a site lasts. "Persistent cookies," however, stay on your computer to track return visits as well as visits to partner sites. Why so much tracking? The point is to establish a profile of you as a consumer. That helps marketers and content providers deliver more targeted information and advertising.

How to Fight Back

Open your browser's options or preferences and "show cookies," then prepare to be astounded. You are likely to find hundreds, if not thousands, of these markers. In your privacy settings, you can simply turn cookies off, but that may keep some Web services from working correctly. At the very least, turn off "third-party cookies" to ensure that only the sites you visit can send cookies to your computer. For sessions where you want complete privacy, look for a "private surfing" option on your browser.

users log into a Web page and get daily reports of their subjects' movements and even chart their activity using Google Earth, the search giant's free satellite imagery software.

Too often, these tools end up in the hands of stalkers and obsessed former lovers. According to Cindy Southworth, director of the Safety Net Project—a nonprofit that trains law-enforcement officers to understand the role of technology in domestic abuse—computer spyware and GPS tracking services are showing up in a huge number of stalking and domestic violence cases. "We get at least one call a week on a new case where spyware is being misused in stalking and ex-lover cases," Southworth says.

In 2006, Washington state resident Sherri Peak suspected that her estranged husband Robert was tracking her movements. An investigator confirmed her fears: Robert Peak had hidden a cellphone and a GPS tracking device in the dashboard of her car. Peak rigged the phone so he could dial in silently and listen in on his wife, while tracking her movements on his laptop computer. Peak pleaded guilty to felony stalking and was sentenced to eight months in prison.

Data Trafficking

THE WEALTH OF FREE content and services that Web surfers find so valuable is largely supported by a hidden economy. Companies give away software and services in exchange for the ability to collect and share data

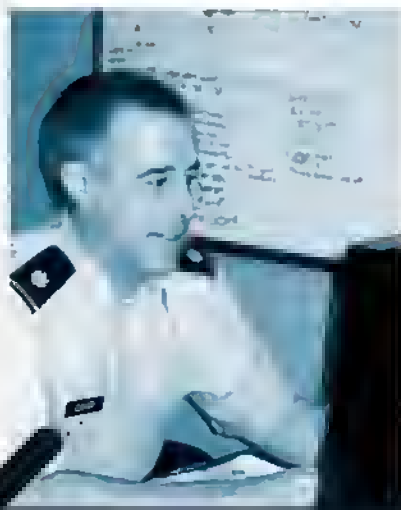
about where users go online, as well as what they're searching for or buying. With advertisers under pressure to collect ever more detailed information on consumers, the stakes are enormous. According to a report commissioned last year by the Interactive Advertising Bureau, online advertising

in the U.S. grossed \$21.2 billion in 2007, trumping cable (\$20.9 billion), radio (\$19.8 billion) and broadcast television (\$19.2 billion).

The tool most commonly used to track user behavior is the HTTP "cookie." Cookies are not programs, but chunks of code stored on your computer to identify you as you move from page to page on a Web site. Without cookies, most retail sites wouldn't be able to offer virtual shopping carts or remember the preferences of their users. But the use of cookies has become far more sophisticated than mere account management. And that troubles privacy advocates.

"Free Web services aren't free," says Gregory Conti, a computer science professor at the United States Military Academy at West Point. "We pay for them with micropayments of personal information. Users aren't entirely oblivious to the fact that information is being collected, and they're doing a cost-benefit analysis, but they're not thinking long-term."

Even those who take the time to read a Web site's privacy policy may



"FREE WEB SERVICES aren't free," says Gregory Conti, computer scientist at the U.S. Military Academy. "We pay for them with micropayments of personal information."

not realize how many companies have access to their data. That's because most Web sites pull advertisements, snippets of code and other content from a number of third-party sources, any one of which may track the visitor and use the data in a manner that differs from the host site's data-collection policies. "When you visit msnbc.com, you're actually visiting 16 third-party sites, 10 of which are from different companies," Conti says, referring to the secondary content of providers and advertisers whose data make up the page. "You're really dealing with the lowest common denominator privacy policy when many sites are involved."

Just how much data are advertisers collecting and sharing? In a study commissioned by *The New York Times*, Internet research firm ComScore found that on average Yahoo and its advertising-partner networks collect more than 2500 bits of data from each user per month. Every time Yahoo users enter a search query, their profiles become more detailed.

Advertisers piece together digital dossiers on consumers by collecting these tiny fragments of information. But the mother lode of personal data is in the hands of the Internet service providers (ISPs), who know exactly who their subscribers are, where they live, where they go online and with whom they communicate. Because a service provider is the point of first contact between a consumer and the Internet, all data traffic going in and out of his or her household goes through the ISP's routers. Logs of that information can be stored on an ISP's servers for an indefinite period of time.

With such a wealth of valuable information, some ISPs are starting to share this data with marketers. In May 2008, St. Louis-based Charter Communications, the third largest publicly traded cable operator in the United States, announced plans to serve customers with ads based on the content of the Web sites they visited.

The company that powers this so-called "deep-packet inspection" service, NebuAd, based in Redwood City,

Calif., had similar deals with more than a dozen other U.S.-based ISPs. After a public outcry, the House Energy and Commerce Committee last summer opened an inquiry into NebuAd's controversial tactics, forcing the company to put a temporary hold on its technology for tracking ISP customers.

ISPs are prohibited by law from sharing the content of their customers' digital correspondence, but the peripheral details of your browsing, e-mailing and online shopping habits are fair game. "The only thing that would prevent an ISP from giving away or selling this data to marketers is its own privacy policies," says Kevin Bankston, a senior staff attorney with the Electronic Frontier Foundation. "So there's a big question right now of which ISPs are selling what data to whom, and the answer is we really don't know."

The Privacy Cloud

THE ONE FOOLPROOF countermeasure to prevent prying marketers and hacker snoops from digging into your data has always been to yank the cord. Data can't be siphoned off an unconnected computer. But consumers are increasingly leaving everything from e-mail to photos to documents on off-site data-storage services—a trend known as cloud computing. Tech heavyweights such as Amazon, Google, IBM, Intel, Microsoft and Yahoo market the services as everything from disaster backup and recovery solutions to Web-based software that allows consumers to access and work on their files from any digital device on the planet. The advantage of this approach is obvious: If your data isn't located on any one machine, it can never be lost or corrupted. But when your personal data isn't on your personal computer, it's out of your control.

Experts warn that data left in the cloud does not enjoy the level of legal and privacy protections as the same data residing on the user's home PC. "The police can only get into your home if they have a search warrant, but the laws for police access to remote servers are much looser," says Peter Swire, a former privacy advisor to the Clinton administration who now

CONTINUED ON PAGE 103

E-Mail

"E-mail messages are just like digital postcards. They can be intercepted and read," says Brian Czarny, an e-mail security expert at Webroot. Many people treat e-mail as a private conversation between themselves and the recipient, but most e-mail travels as plain text that is easily readable at any of the routers or e-mail servers it stops at on its way to delivery. Some users have switched to online e-mail accounts in recent years. Services such as Gmail and Yahoo Mail digitally scan the contents of your e-mail to deliver context-appropriate ads. And, like most content stored in the "data cloud," online e-mail doesn't have the same legal protections as e-mail stored on your home computer. To search the contents of your computer, law enforcement officials must first have a warrant to search your home, but access to online content requires only a court order to your e-mail provider.

How to Fight Back

The only way to keep your e-mail private is to encrypt it with software such as Mozilla's Thunderbird e-mail program equipped with the Enigmail plug-in. For connecting to online e-mail, check your account's preferences and select "connect using https" if available. This won't encrypt your e-mail, but it will at least encrypt your connection to your e-mail account.

the joy of

WELDING

LAYING THE PERFECT BEAD IS A DELICATE ART. MASTER THE CRAFT AND ORDINARY MILD STEEL BECOMES A BLANK CANVAS FOR INVENTION.

by Mike Allen // photographs by James Westman

A thing of beauty is a joy forever. And around our Saturday + Mechanic shop, beauty often takes the form of a perfectly laid welding bead—one that looks like a tall stack of dimes laid on its side. Okay, welding has some practical aspects, too. Your world, as a tinkerer and fabricator, fundamentally changes when you can permanently fasten two pieces of steel together in seconds. Sure, it takes years of experience to perfect the craft, and an investment in welding equipment. But don't let the cost intimidate you. For most backyard projects, top-level welders aren't necessary. A consumer-grade welder costs only a few hundred dollars. A better machine lasts longer and has a longer duty cycle, too. But unless you plan on welding a safety cage for your race car, an expensive welder is overkill. A good setup (with accessories and protective gear) costs around \$500 and lets you weld mild steel up to ¼ in. thick.

The first project most new welders tackle is predictable—you need a shop cart to hold that new welder and warehouse the accessories. Our cart took only a few hours to complete. It has a rack along the back for C-clamps, a couple of coat hooks for hanging helmets and wiring, and an upper deck to hold a plasma cutter. The design is simple, so you can customize it for your own needs. Expand on these simple techniques to make patio furniture, repair bicycle frames or build that junkyard sculpture that's been rattling around in your head for years.

So what's the best way to learn welding skills? Sign up for a course at a community college or vo-tech school. You'll learn proper safety procedures, have access to different types of welding machines and get plenty of practice. As you become more skillful, you'll want to tackle more ambitious projects. Have fun—make something beautiful and sturdy.



// the Equipment

Auto-Darkening
Helmet

Safety
Glasses

Particle
Mask

Chipping Hammer

Leather Cape

Welding Gloves



Handy Square

Its right angle is useful for quickly squaring up joints. Use it with a scratch awl to mark metal with lines that can be read after welding.



Angle Grinder

The single most versatile tool a welder needs. Use it for fitting joints, removing burrs and slag, and grinding excess weld bead.



Chop Saw

For occasional use. We just fit our inexpensive compound miter saw with an abrasive metal-cutting blade.



PHOTOGRAPH BY CHAD HUNT (SAFETY GEAR)



Let the sparks fly.



The Art of Puddle Control

Before you weld two pieces of metal it's important to tack them. Tacks (series of small welds) hold the workpieces together, ensuring they won't warp as you weld. But

the one fundamental skill in welding is puddle control. Welding uses a heat source to melt the edge of both workpieces and a filler rod into one molten puddle. Then you simply march the puddle along the seam. It sounds simple, but welding is a delicate dance between heat, filler rod and puddle control.

// Let's make something, eh?



1 + 2 + 3

Lay it all out.

In this case, on a flat, noncombustible surface—the shop floor. Now square up the pieces of the frame and lightly tack-weld them together. Some clamps or weights will hold everything in place.

Cut here.

You could hacksaw these pieces of $\frac{3}{4}$ in. angle iron easily enough, but you can save some time by using an abrasive metal-cutting blade as the wheel in a chop saw. A slow, steady feed cuts fast without making excess heat.

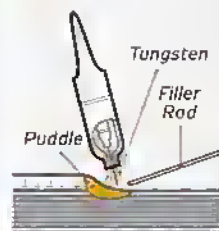
Proper tacking is important.

Weld just enough to pin the parts together. As you add more parts, adjust to keep everything square. Never finish-weld any joints until you have a fairly complete subassembly that's well tacked; measure diagonally to square things up.

// other types of Welding

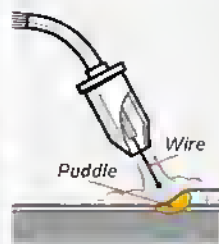
TIG Welding

Instead of a consumable electrode, which conducts current and melts into the metal, a TIG (Tungsten Inert Gas) machine has a nonconsumable tungsten electrode to strike the arc and establish the puddle of molten metal. A separate filler rod, held in the welder's other hand, is added to fill the puddle.



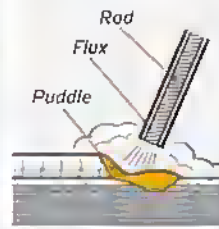
MIG Welding

Use a solid-core filler wire, surround it with an inert gas like argon or CO₂, and your wire-feed welder becomes a MIG machine (Metal Inert Gas). It leaves a cleaner, slag-free weld and can be used on stainless steel or aluminum.



Stick Welding

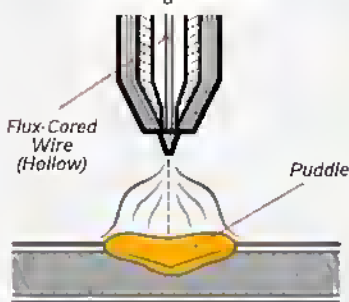
A flux-coated metal electrode that melts into the puddle and fills the bead is faster for welding thicker pieces. But stick welding is overkill for a lot of household projects, and it takes practice to do it well.



the joy of
WELDING

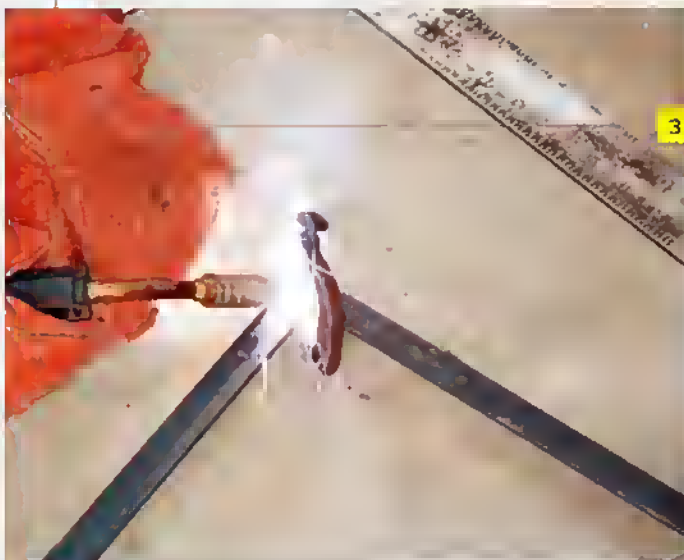


// featured Welding Process



Wire-Feed

Inexpensive wire-feed machines use a spool of hollow, flux-cored wire that feeds out automatically. Originally developed for welding outdoors at windy construction sites, wire-feed welding is ideal for beginners trying to complete projects around the house.



PHOTOGRAPH BY BRAD DECESCO (FINAL CART),
ILLUSTRATIONS BY GABRIEL SILVEIRA



ON THE WEB > Find plans for this welding cart at popularmechanics.com/weldingcart.

4 + 5 + 6 + 7 →

Cope it out.

We used a plasma cutter to trim part of the angle iron at the joints. This is known as coping, and it allows the pieces to fit more closely. You can achieve the same thing with a grinder or even a hacksaw.

Keep adding parts.

After you assemble the front and rear frames, add the horizontal frame elements. Another pair of hands can help here. Tack everything together, and check that it's all square before attempting full welds.

Good posture helps.

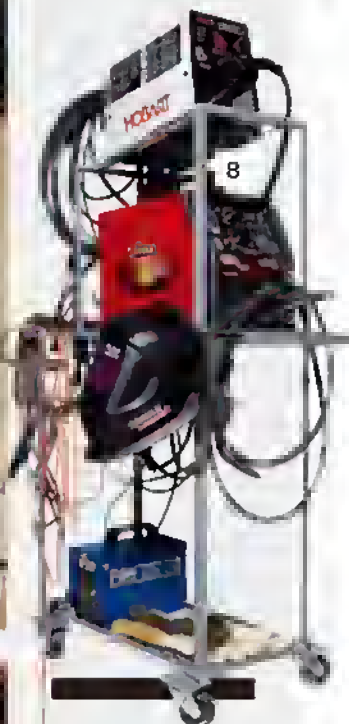
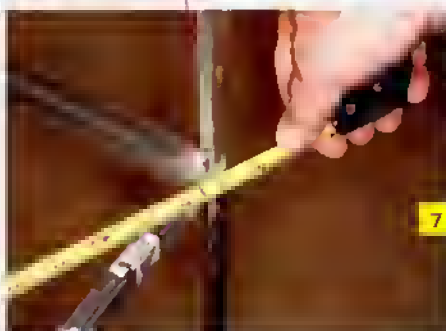
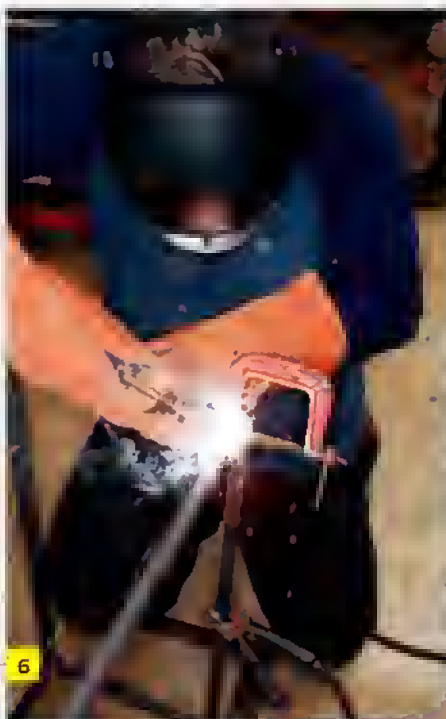
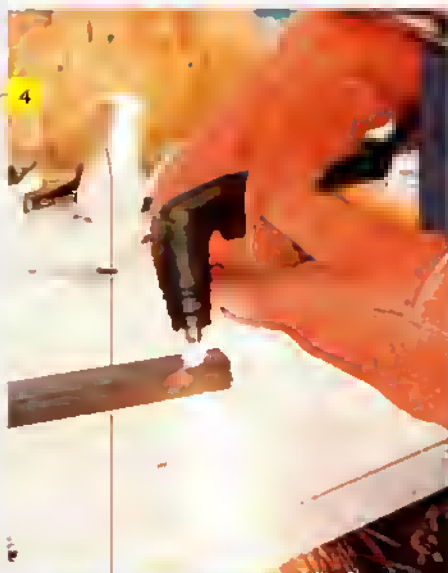
If you're not comfortable, the weld bead is going to wander. Use both hands to hold the welding gun, and brace at least one elbow against your torso. Rehearse the movement in longer beads with the welder shut off.

Measure, and measure again.

As you build up, constantly check the assembly for squareness by measuring across diagonals. Use a few light hammer taps to correct to within $\frac{1}{8}$ in. before you finish the weld.

End result:

We added a handle, a rack for clamps and ground cables at the rear and, of course, wheels and casters. Shelves are made of expanded metal, so they won't collect dust or slag. Then we sandblasted the slag off the welds and finished with Hammertone silver paint. The cart is topped with a plasma cutter—one that cuts $\frac{1}{4}$ -in.-thick steel plate like warm tofu.





TOOLBOX + CONCRETE
COUNTERTOPS + FLOOD DAMAGE

DIY HOME



Concrete Decision

Q My friends had a concrete counter installed in their new kitchen. I really like how it looks and was considering making one myself. It doesn't look like it would be all that difficult to make, to tell you the truth. What do you think? Any advice before I start?

A Making an attractive kitchen counter out of concrete is a big job and a real challenge. It combines artistic skills with those that you would need to build a patio. For one thing, consider that cured concrete

weighs 150 pounds per cu ft, so casting it, moving it and positioning it all add up to a big and messy undertaking. Still up for it? Well, PM readers do like a challenge.

Here's an overview of the process.

First, you build a form from melamine-coated particleboard. Place the form on the floor or on an extremely sturdy workbench. Then mix the dyed concrete and pour it in. Level it, float it and—if you intend the visible surface to be the top—trowel it smooth. (It's riskier, but you can also use the side facing the melamine as the eventual top.) Use an oscillating sander or rental concrete vibrator on the side of the form to ensure that cement paste fills small voids, especially near the edges.

Once it's cured, remove the counter

from the form. Arrange for a helper and use a heavy-duty hand truck to move the project. For a large counter, consider renting a refrigerator-moving dolly to help you get the big brute up the stairs. Also, if you need to, fill small voids and imperfections that escaped the vibration. Then grind and polish the counter with diamond abrasive pads. Finally, apply an epoxy or polyurethane formulated specifically for concrete—this seals the concrete and prevents it from being easily stained by food spills. (It can also build up a thin film to prevent abrasive damage to the surface

you worked so hard to make look perfect.) All told, from the form to the specialized tools, a 2-in.-deep, 20-sq-ft counter will take a weekend for a homeowner to construct and will cost about \$400 to \$600.

Then, of course, you need to fit it in place. It can take some practice and plenty of research to get this project right. Before you start, read a book on the subject. There are several, and a very basic tutorial is contained in the new *Quikrete Guide to Concrete Masonry & Stucco Projects*. Then, don't just head down to the local

home-improvement megamall to shop for materials. At concreteexchange.com or similar online sites you're more likely to find the colorants, tools and concrete additives that pros count on to provide the smoothness and density of the surface. After all, it's a food-preparation surface you're creating, not a sidewalk. Finally, make a small test counter or a tabletop before taking a run at building the full-length counter of your dreams. You *will* make mistakes the first time around.

■ HOME SWEET HOME

Counter Intuitive A CONVINCING FAUX-CONCRETE FINISH

You've probably already seen one of these: a kitchen or bath counter that looks like it's concrete or something close to it. It's probably SkimStone, a cementitious coating that's applied in multiple thin coats to a substrate such as an existing laminate top. Although it'll tie up your kitchen counter for about a week while you apply it, it's an attractive alternative to a true concrete counter, because it's not as labor intensive as the real thing. Also, there are times when it makes more sense to paint your kitchen cabinets, replace the pulls and refurbish a sound but unattractive counter, especially when your time and remodeling budget are limited. All of the

SkimStone is applied by trowel and pad in thin layers that are built up to yield a look similar to burnished concrete.



SkimStone materials and tools to do a typical counter would cost about \$350. You can use the coverage calculator at the company's Web site to estimate materials (modernmasters.com).

The first step in applying a SkimStone coating is to thoroughly clean the existing counter. Even



though the manufacturer says it's best to remove the sink, it's not strictly necessary.

Next, trowel on the material's bonding primer. Its rough surface provides the necessary tooth for a second layer of bonding primer and subsequent SkimStone topcoats that add color and make the finish more convincing. This includes three or four coats of protective sealer and a water-based finish. These multiple layers are considered fully cured after about a week.

Flooded Electricals

We returned from vacation to find that a broken plumbing connection to our well tank had flooded our basement. The water got so deep it went up to the service panel, submerging the bottom two breakers. We've dried out the basement—now what do we do about the wiring?

Call an electrician. In the rush to get life back to normal, many homeowners dry out a flooded basement and then just go about their business. That amounts to a gamble. Flooded electrical components that appear to be working fine after they dry out may not stay that way. They sometimes continue working right up until the moment something bursts into flames.

"After shutting power to the service panel, I'd replace any circuit breakers that got wet," advises PM contributor and electrician Pat Porzio. "By the way, a good electrician will also look for any other signs of corrosion inside the service panel. It's not uncommon for a bad seal at the top of the meter to allow rainwater to leak in."

Most interior residential wiring is designed for dry locations, so it must be replaced after it's flooded, along with switches, dimmer switches, outlet receptacles and GFCI receptacles, according to standards established by the National Electrical Manufacturers Association. An inundated motor for a furnace blower, for example, may be fine once it dries out. But NEMA says you should check with its manufacturer to be sure and to find out what methods, if any, are necessary to clean and lubricate it. To find out who the manufacturer is, look at the

motor's name plate. This plate may not be obvious—sometimes it's behind or even under the motor. If the motor is controlled by a capacitor, a relay or a printed circuit board, then such components will need to be replaced. It may be simpler and less expensive to replace the entire device rather than its components.

Year-Round Adirondack Chairs

We leave our Adirondack chairs on the deck year-round and use them on nice winter days. I'd like to bring them into the garage this winter and stain them. What stain should I use? On the other hand, if the stain will be damaged by the cold when I take the chairs outside, I might as well wait until spring.

Many exterior wood stains, acrylics and alkyds (oil, in other words), can be applied at temperatures as low as 50 F. So long as the temperature in your garage is at least that, you'll have no problem applying the finish or taking the chairs back outside once the stain has fully dried. The chairs will need much longer to dry in a cool garage, however, than they will outside on a warm summer day. Allow several days of dry time.

If the chairs are made out of softwood, you can use a standard deck stain that's also rated for outdoor furniture. Avoid using a stain rated just for siding or vertical surfaces such as fences. It won't hold up well on the chair seat or the top of its arms, which are horizontal surfaces, because water sits on these. If the furniture is made from an imported tropical hardwood, use a coating specifically formulated to adhere to its dense, resinous cell structure, such as Cabot's Australian Timber Oil.

Regardless of whether you press ahead with the project or wait until spring, all standard surface-preparation rules apply.

Scrub the chairs with a wood cleaner to remove mildew and sun-damaged wood, sand away splinters and replace rusty fasteners and any cracked or rotted wood.

Bouncy Floor

Our ranch house has 2 x 8 floor joists that span 12 ft from the foundation to the beam in the basement's center. Aside from the fact that the floor feels uncomfortably bouncy, it appears to cause the bathroom floor to flex and to crack the grout between the tiles. What should we do?

ARE YOU READY FOR THIS?



Check all that apply:

- I have a collection of old dull drill bits I just can't throw away.
- I'd rather spend my money on new tools than on buying more drill bits.
- I know I should sharpen my drill bits, but I don't have time to become a sharpening expert.
- I want to drill clean, precise holes every time.
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Engineers, architects and builders often say that when you build to meet the building code, but nothing more, you produce the worst possible house permitted by law. In other words, unless the house is built to exceed code, it's condemned to a life of annoying mediocrity. That's what has happened here. Depending on the lumber grade used, your

house's floor barely meets code, or just misses it. (Heaven forbid someone would have used wider floor joists topped by a sturdy subfloor.)

The typical carpenter's solutions are to install additional framing between the joists (known as bridging), to add a beam in the basement that will support the floor at midspan, or to screw plywood to

the bottom of the joists. Many carpenters add bridging only to find it improves but doesn't solve the problem. The beam and its posts will use valuable basement space, and the headroom underneath will be quite low.

The plywood solution isn't a small job, but it's the most likely to produce a very stiff floor. "Each floor joist topped by the plywood subfloor is essentially a T-beam. Adding plywood below it makes it even stronger and converts it into an I-beam," says Dan Burgjohann, an engineer with Stanley Bostitch Construction Products who specializes in fasteners for wood-frame construction. "The fact that the joists are then connected to one another by plywood above and below converts the entire floor system into a single very rigid beam."

It's hard to say what plywood thickness would be best, since building codes don't really address repairs like this. Erring on the side of overkill wouldn't be a bad idea, though, because you want to solve the problem. That would mean using $\frac{3}{4}$ -in. plywood, construction adhesive applied to the bottom edge of the joists and 2-in.-long No. 8 wood screws driven 8 in. apart or so. I'd use fasteners with an aggressive self-tapping tip, since you'll be driving these things over your head and you'll need all the help you can get. Don't use drywall screws, Burgjohann advises—they're not designed to handle the bending loads that will be applied to them.

If the plywood eliminates the bounce, you'll probably have to do nothing more than regrout the bathroom floor (this assumes that no tiles have come loose). In the unlikely event that a slight bounce remains, you need to decide whether to keep the tile floor. If you do, then it would be best to support the bathroom floor from below on a beam supported by 4 x 4 posts. Otherwise, a simple solution would be to replace the tile floor with a flexible vinyl floor.

PM

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Classics: Simple Do-It-Yourself Projects

Tough Box

GIVE YOUR TOOLS A STRONG, STURDY HOME WORTHY OF THE WORK THEY DO.

Toolboxes these days look less and less like boxes. They're bags, usually. You might go so far as to call them tool purses. No matter how tough the ballistic nylon, a sack just doesn't have that same lunch-pail appeal as a rigid, stiff-sided rectangle.

The homebuilt box shown here has a nickel handle as beefy as a billy club, a diamond-plate exterior, sturdy oak ends—and there's not a stitch of fabric to be found. Its open-top design lets DIYers store tools too large to fit beneath a lid, and skidproof feet stop it from sliding around a truck bed. Plus, the job's entry-level metalwork gives you an excuse to buy a brake to bend all manner of sheetmetal.

Machinists used to craft their own

chest as a rite of passage after apprenticeship. You can fill the box with the wire strippers and spare switches in your electrical kit, or the tubing and wrenches you save for plumbing jobs. Better yet, reserve your box for the basic carpentry tools you'll use to build it.

*design by JOSEPH TRUINI
text by HARRY SAWYERS
photographs by ZACH DESART*



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1 Using a circular saw fitted with a metal-cutting blade, trim 4 in. from a piece of 0.08-in. diamond-plate aluminum that measures 24 x 24 in. You could use a jigsaw, but the cut won't be as straight or as smooth, even if you employ a straightedge guide.



2 Place the aluminum, with the diamond-plate pattern facing down, in a sheetmetal brake. Bend the metal to create 6-in.-high sides and an 8-in.-wide bottom.



3 Trace the three sides of the toolbox outline onto oak 1 x 12s cut 11 in. long. Using a table saw or a circular saw with a woodcutting blade, rip the boards on the marks. Cut 6-in. notches $\frac{1}{8}$ in. deep in each edge so the metal plate sits flush in the ends.

The Process

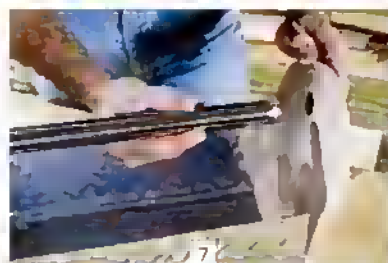
Use a pencil compass to strike a $4\frac{1}{8}$ -in. radius onto the top of each oak end. Measure $1\frac{1}{2}$ in. from the top of the radius to find the center of the 1-in.-dia handle holes. Using a jigsaw, cut along the pencil arc. Make a second cut to round off the two bottom corners.



Bore $\frac{1}{2}$ -in.-deep handle holes on the inside surface of each oak end using a 1-in.-dia Forstner bit in a drill press. Apply a thin bead of clear silicone adhesive along one bottom inside edge of the toolbox. Do not apply adhesive to both ends.



Clamp an end inside the box. Drill $\frac{3}{16}$ -in.-dia pilot holes through the metal and oak. Countersink each hole. Using 1-in. No. 10 Phillips screws, fasten the metal to the oak, driving two screws per side and bottom.



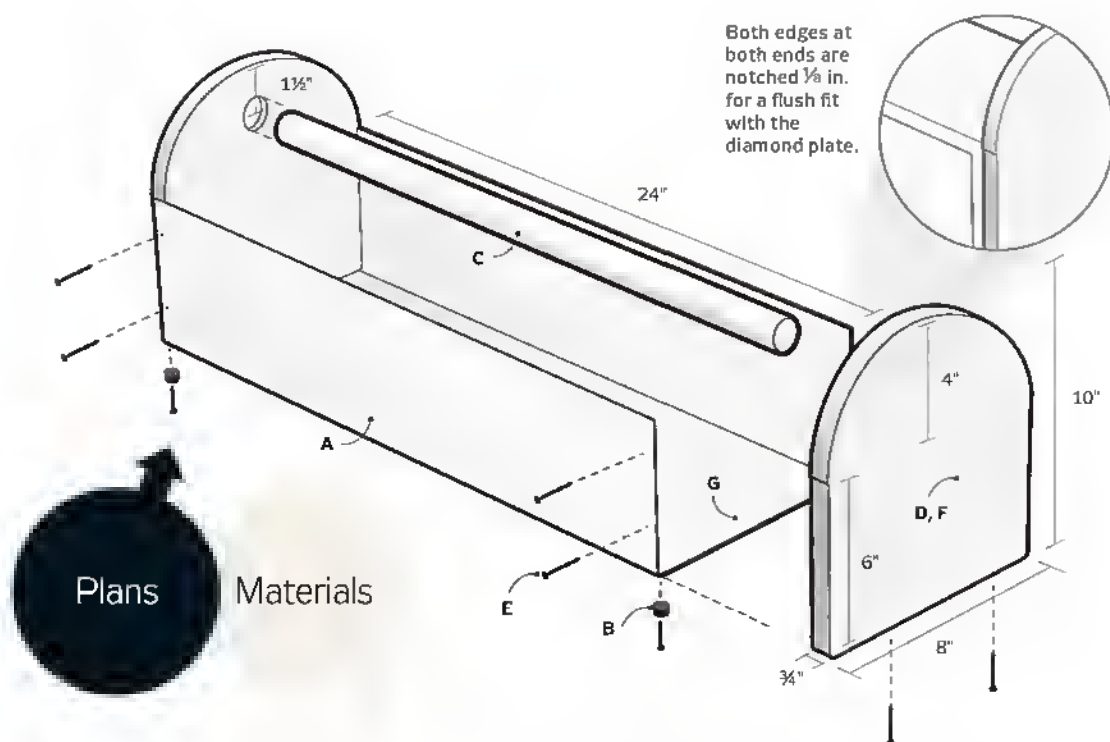
7 Trim the handle to $23\frac{1}{4}$ in. with a hacksaw. Fit the handle into the attached end. Using silicone and screws as before, install the remaining oak end. Screw four 1-in.-dia antiskid rubber feet to each corner of the toolbox bottom.



8 Hand-sand both sides of the ends with 80- and then 120-grit sandpaper. Sand the arcs with 120. Smooth the top edges of the aluminum with a mill bastard file.



9 Hand-rub an oil finish on the oak ends. Wait 4 to 6 hours, then rub on another coat. Let it dry overnight before using.



Key	No.	Size and Description (Use)
A	1	24 x 20-in., 0.08-in. aluminum diamond plate
B	4	Rubber bumpers (feet)
C	1	$\frac{3}{4}$ -in.-dia x 23 1/4-in. steel pipe (handle)
D	2	$\frac{3}{4}$ x 8 x 10-in. oak (sides, cut from 1 x 12)
E	12	No. 10, 1-in. Phillips screws (for slides, bottom)
F	1	Pint Watco Natural Danish Oil
G	1	Tube silicone adhesive

Where to Buy

24 x 24-in. aluminum plate, quickshipmetals.com
 Shepherd Hardware Products, item 9644
 Nickel downrod extension, 24 in. long
 .
 .
 .

Specialty Tools: Sheetmetal brake (\$50) from tunerschoice.com; metal-cutting blade from dynamicsaw.com; 1-in. Forstner bit, countersink bit from rockler.com.

PUTTING IT TO USE

The toolbox can be used for anything, but we vote for a plumbing kit. It's about the right size, and the aluminum will stand up to damp duty. Here's a starter supply list.



1. Torch To sweat copper fittings, opt for a propane self-igniting tip.

2. Hacksaw Cuts pipe, hardware, screws, nuts, bolts and PVC.

3. Metal File Smooths edges, removes burrs on cut pipe.

4. Basin Wrench Use the long

shaft and swiveling jaw to torque nuts under the sink.

5. Pipe Wrench It lets you get a grip on pipes, nuts and fittings.

6. Hand Auger Flex a 25-ft cable to clear clogged tub and sink drains.

7. Adjustable Wrench Shifts

its span to fit all sizes of nuts and bolts.

8. Tongue-and-Groove Pliers The tool of choice to grab, pull, twist, hold, tighten or loosen.

9. Tubing Cutter Quickest, cleanest way to cut copper pipe. A mini model works in tight spaces.



New New Year's Resolutions

THE TOOL-USER'S GUIDE TO A BETTER 2009. BY HARRY SAWYERS

As each year ends and another begins, Americans make the same old resolutions. Stop smoking and drinking, travel, lose weight and spend more time with the family. There's nothing wrong with those ideas. Sort of. But we at PM propose an alternative—a path to self-indulgence through a few good home-improvement projects. In 2009, resolve to start smoking, keep drinking, stay on the couch, gain weight and spend less time with the kids. You've got the skills. All you need is a little push in the right direction.

1. START SMOKING Grilling makes for good eats, but true barbecue is a spiritual exercise. For the ultimate in smoked-meat manna, you need a classic barrel smoker with an offset firebox—like the one shown above, designed by PM's Mike Allen. (For full plans on how

to build it, see popularmechanics.com/home_journal/workshop/3372796.html.)

"It's all about controlling temperature," says Jamie Purviance, author of *Weber's Big Book of Grilling*, and a smoker gives you ultimate control. "By the time the heat hits the meat,

it's not so hot." Keep the temperature at 225 to 250 degrees "if you want the meat to just dissolve," he says.

It's easiest to maintain that temperature using a detached firebox, which allows you to add fuel without losing the smoke and heat circulating in the smoker box. As for fuel,

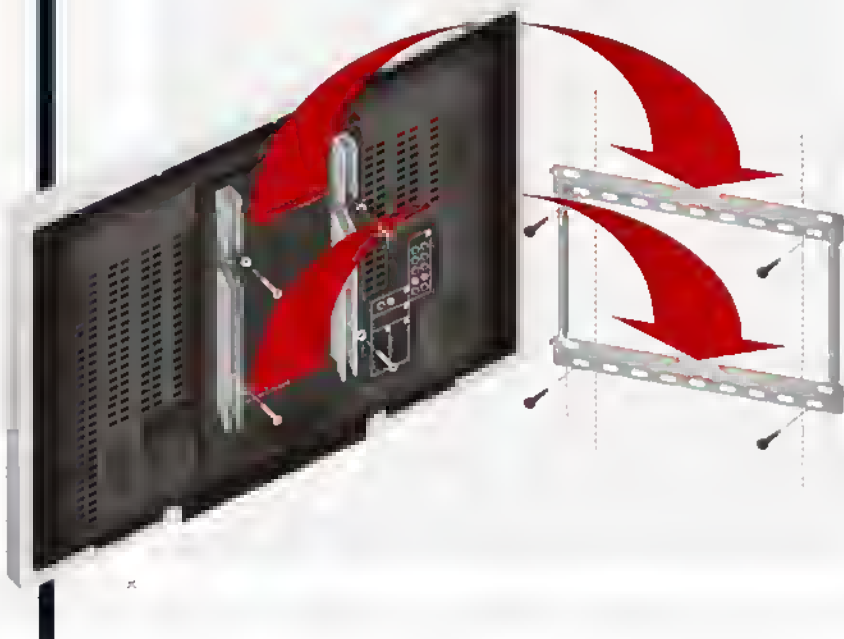
2. STAY ON THE COUCH

Travel is great, but what exactly is wrong with watching football in the comfort of your Barcalounger? Let the world come to you with a wall-mounted flat-panel TV screen. Don't be intimidated by the prospect of hanging several thousand dollars' worth of electronics. "Most mounts are so easy to install—the hardest part is finding the studs," says Jarrod Judo, a technical expert at manufacturer Sanus Systems.

Some mounts swivel on an articulating arm, but tilt mounts, which simply adjust up or down, are more common. Screens larger than 40 in. require a two-stud mount. Although smaller TVs can use

single-stud systems, the dual-stud mounts allow the TV to shift laterally for positioning. (The single-stud approach limits placement.) Before committing to a style, enter your model on a "mount finder" function online—manufacturer OmniMount lists models from more than 175 television brands, and Sanus's Web site has a similar matchmaker service.

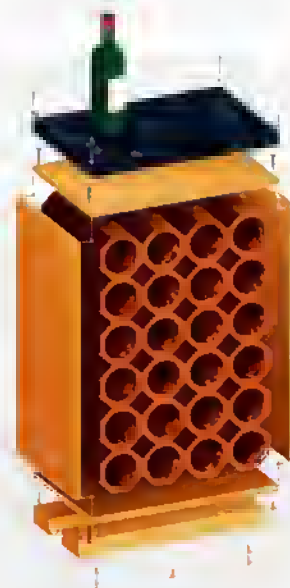
If you have metal studs, or if you're anchoring into masonry, mention it when ordering and manufacturers can provide hardware specific to those surfaces. Either way, the basic setup is a two-piece system—one part anchors into the wall, the other into the back of the TV, and the two either slide or clip together as you and a helper move the flat-screen into position. Judo recommends dry-fitting everything on the ground, just to confirm compatibility, before you begin drilling holes.



Purviance often adds mellow-flavored oak to his charcoal, but mixes in apple wood for a sweeter smokiness, or adds mesquite for a rich, zesty taste.

If you're not ready to weld—or buy—your own barrel, a basic charcoal grill can smoke a rack of ribs so tender they'll fall off the bone.

Pile the charcoal and wood on one side of the grill and the meat on the other, then open the lower vents and those above the meat. This indirect cooking method draws smoke from the coals up past the meat, slowly roasting it until the thermometer tells you it's time to eat.



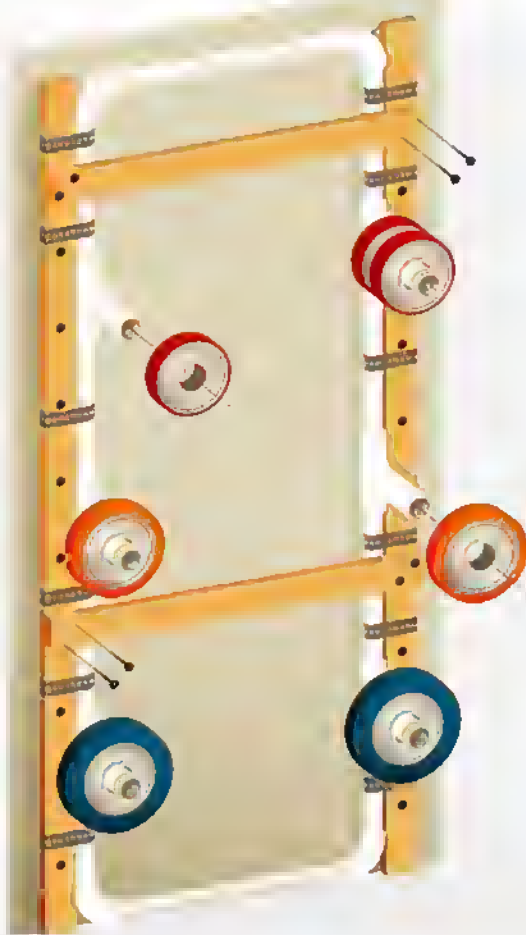
3. DRINK MORE

Deluxe wine closets do a nice job coddling your bottles, but you can build a classy, cheaper rack using $\frac{3}{4}$ -in. plywood and stackable terra cotta wine tiles. The durable tiles keep the wine at a constant temperature, says Mike Seibold of tile-maker Superior Clay. They come in six- and eight-sided versions and cost about \$5 to \$7 each. Seibold favors the octagonal style for stacking, while the hex-sided tiles can give the rack a more honeycombed look.

Clay masonry products vary in size, so measure the 5- to 6-in.-dia tiles on site before you plan cuts in plywood. At any size, the basic design remains the same: a box with a closed back and one open side to access the bottle-necks.

Plan for the top and bottom plywood sheets to overlap the sides so that you can predrill pilot holes and drive 2-in. drywall screws in from the top and bottom. Measure and cut a panel to fit the rear of the box, and mount it to the four plywood sides. Two 2 x 4s cut to fit across the bottom lift the case off the floor.

Arrange the tiles to fit your space. A case about six tiles high approximates the typical countertop height of 36 in. Top that with a scrap of stone, and give a tasting as you show your work.



4. **GAIN WEIGHTS**

Slimming down on the elliptical is fine, but don't neglect the benefits of pumping some iron. "Resistance training not only enhances muscle, bone and connective tissue, but it can also help fight the effects of aging and reduce your risk of injury," says Dr. William Kraemer, Professor of Physiology at the University of Connecticut. Use PVC scraps to build this customized weight rack and you can bulk up your equipment as well.

"Most of the weight storage racks for sale are too heavy, too expensive and take up too much floor space," says Anthony Verducci, PM's digital imaging expert. Verducci

built this system as a unit before installing it. First he cut several 35½-in.-long 2 x 4s to span the distance between two stud bays. He fastened these pieces at right angles across another pair of 2 x 4s cut to fit from the floor to the ceiling in his basement workout area.

Verducci then used 90-degree elbows and PVC cement to join four PVC sections in a rectangle between the vertical 2 x 4s. Drain tailpieces added intermittently along the vertical runs make arms to hold the weight plates. Rubber bands wrap the hacksaw-cut arms, preventing the plates from slipping off. With the pipe braced behind the horizontal 2 x 4s, he fastened the wood and PVC together using pipe strapping. He raised the assembly, anchored it to the wall studs and added weights.



5. **SPEND LESS TIME WITH YOUR KIDS**

Organized sports and other activities are great, but kids also need unsupervised recreation. Installing a basketball hoop lets them hone their moves, social smarts and independence—and have fun.

Our suggestion: Skip the sandbagged portable models—the backboards rattle instead of emitting a satisfying gym-quality thunk on a bank shot—and drop a rock-solid pole in concrete over a couple of weekends. Day one is devoted to digging and pouring concrete. Prepping the footing is about 70 percent of the work, says Keith Tate of Houston-based manufacturer Pro Dunk.

Here's a rule of thumb for digging the hole: Dig out one-third the length of the pole and three times the diameter. Tate says to "belly out" the bottom of the 3- to 4-ft hole, creating a bell-shaped mass of concrete to keep the pole from pulling out. "We pour about 950 pounds of concrete," he says. "It seems like a lot, but the way people like to do slam-dunks, it's important."





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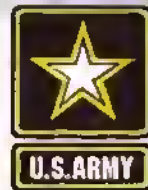
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Anatomy of a Repair Order

SIGNING THAT
REPAIR ORDER
DOESN'T HAVE
TO HURT SO
MUCH. HERE'S
HOW TO READ
BETWEEN THE
LINES.

BY MIKE ALLEN

Your car won't start. Again. Luckily, you have a manual-shift transmission and manage to bump-start it in the driveway. First stop? The repair shop. The service writer takes your information, and the mechanic takes your car. And oh yeah, while it's on the rack, could you change the oil and rotate the tires, please?

A scant 2 hours later, the service writer calls you at work and delivers the bad news: You'll be paying—big. But at least it's running. Yay. You pay the substantial bill and head off to the

day's activities. Later that evening, you take a few minutes to peruse the repair order. The shop has replaced the starter motor, even though the engine cranked over, albeit slowly. Huh? If the starter motor is turning over the engine, why would it be replaced?

You assumed there was some other issue, probably spark plugs or even a fuel-injection problem. But you're not a mechanic, nor do you play one on TV. You can troubleshoot your repair after it's done—without turning a wrench. Here's an overview of the sometimes confusing world of the repair order.

Deconstructing the Repair Order

When you bring in your car with a complaint, the service writer gives the mechanic his interpretation of your issues in the instructions area of the RO. Now it's up to the mechanic to figure out what's wrong. His first diagnostic task for this slow-cranking, nonstarting car is to check the electrical system to determine the cause of the slow cranking. That usually means charging the battery or at least checking the state of charge. So he tests the battery, which includes charging it to a full 12.8 volts, then load-tests it, eliminating the battery as the problem.

Another attempt to start the engine proves unsuccessful, so the mechanic measures the voltage again, this time at the battery's positive terminal and at the starter motor's positive terminal, while the starter is trying to crank the motor. The respective voltages are a very low 7.7 volts and within 0.3 volts, eliminating the wiring as the cause. The RO doesn't specify, but I'll bet he checked the ground wiring from the battery to the engine for voltage drop as well.

Conclusion: a bad starter, one with an internal short that made it draw excess current. The slow cranking and high current drain undoubtedly lowered the voltage in the system below 8.5 volts, the point where the fuel pump, fuel-injection or ignition system (or all three) could sustain a running engine. The new starter solved the problem. Good news: In this case, your fears of being ripped off by the neighborhood mechanic were unwarranted. →

1 PARTS This is where the mechanic lists all the parts he uses to fix your car. He takes the repair order to the parts window and purchases what he needs from the parts department. They fill in the prices. There may be both new and remanufactured (or even used) parts listed on the RO, as well as a few other charges. The shop is entitled to charge you for the disposal of old tires and for carting off used oil and coolant. Often this is a single, fixed charge that appears on every customer's bill, even if your particular visit doesn't generate any waste. Hey, somebody has to pay for all those red rags.



2 CONTACT INFO Obviously, the service writer needs to be able to find you. He'll need a phone number to call you during the day to verbally okay any additional charges or to advise you if the repair has been delayed in some way.

3 CAR DATA The mechanic needs specific info about your car. In addition to the usual stuff (make, year, model, engine), have the VIN (vehicle identification number) available. It's on your registration card, so be sure you have that in your hand. Some TSBs affect only a certain range of VINs, and occasionally a manufacturer will change parts midyear instead of by model year. The VIN is necessary to order the correct part. It also helps him sort your car from other, similar ones in his database.

4 ESTIMATE Before you sign the repair order, the service writer will have a price for you. In most states, he's not allowed to bill you more than 10 percent above this without your permission. If the repair is potentially very expensive, the customary procedure is to commit you to pay for the diagnosis before quoting you the total cost of the repair. (You agree to removing the cylinder head, for instance, to see if the issue is a bad head gasket or something worse, like a cracked block.) This estimate, by law, has to cover the cost of reassembling your vehicle if you elect not to get the repair done at that particular shop. That's to prevent the shop from strong-arming you into an expensive repair while your disabled vehicle is spread out all over the repair bay like some partially butchered steer.

AUTO REPAIR ORDER / 4P489 4-PART

OFFICE COPY

REPAIR ORDER

REDIFORM, 4P489 POLYPAK (50 SETS)

REDIFORM, CARBONLESS SPEEDSET

QUAN	PART NO. OR DESCRIPTION
1	3200PAAA01R
1	8x1.25 NUT
1	12x1.25x85BOL
1	FILTER 15400ALR

TOTAL PART

QUAN	SUBLET REPAIRS

TOTAL SUBLET REPAIR

ESTIMATE AMOUNT - FOR PAID			
ORIGINAL ESTIMATE \$	BA	AUTHORIZED BY	JGP
PHONE		DATE	TIME
REVISED ESTIMATE \$	540	REASON	10.15 STARTER MOTOR
AUTHORIZED BY	JGP	IN PERSON	
ESTIMATE TO			

5 RETAIN PARTS In most places, state law requires that the repair facility return any used parts to you, if you want them. If you're the suspicious type, like me, or just curious, by all means examine this box and your old parts in it. Usually the mechanic will place it in your trunk. There is an exception: Some items, such as alternators, starters and axles, are often returned to the manufacturer or a third party for rebuilding. You are not entitled to keep these parts unless you want to pay the core charge for them. Trust me, they're happy to see most of the old stuff go home with you. It's just more junk they have to pay to haul away.

AMOUNT		302005	
284.02		DATE 3/19/09	
30		WRITTEN BY BH	
2		OPERATION	
6.87		LABOR CHARGE	
TIME RECEIVED		LUBRICATE X 10	
9:15 PM		CHANGE OIL V 20	
TIME PROMISED		CHANGE OIL FILTER CART V	
NAME JOHN Q PUBLIC		SERVICE AIR CLEANER V	
ADDRESS 456 ELM		CHANGE TRANS OIL	
CITY MAINVILLE		ADJUST TRANSMISSION	
STATE		CHANGE DIFF OIL	
ZIP CODE		WASH FRONT WHEEL BRGS	
MODEL ACCORD		ROTATE TIRES V 20	
YEAR 98		ADJUST BRAKES	
VIN ABC1234			
ENGINE NO 88,409			
TRANSMISSION 3100S188			
PHONE 210-555-1212			
BUSINESS			
I HEREBY AUTHORIZE THE REPAIR WORK TO BE DONE ALONG WITH THE NECESSARY MATERIALS. YOU AND YOUR EMPLOYEES MAY OPERATE A VEHICLE FOR PURPOSES OF TESTING, INSPECTION OR DELIVERY AT MY RISK. AN EXPRESS MECHANIC'S LIEN IS ACKNOWLEDGED ON VEHICLE TO SECURE THE AMOUNT OF REPAIRS THEREON. YOU WILL NOT BE HELD RESPONSIBLE FOR LOSS OR DAMAGE TO VEHICLE OR ARTICLES LEFT IN VEHICLE IN CASE OF FIRE, THEFT, ACCIDENT OR ANY OTHER CAUSE BEYOND YOUR CONTROL.			
SIGNATURE X John Q Public			
DISCARD PARTS			
MECH. OPER.		REPAIR ORDER - LABOR INSTRUCTION	
CRANK-NO START		85	
NO TSBS			
SLOW CRANKING			
BATTERY CHECKS OK 12.8V			
STARTER WIRING OK 0.3V DROP			
CRANKING VOLTAGE 7.7V			
(NEEDS 8.5V TO PASS)			
REPLACE STARTER		85	
QTY. AMOUNT		BILLING	
5 GALLONS OF GAS		CASH OK'D BY	
10 QUARTS OF OIL		CHARGE	
TOTAL GAS OIL & GREASE 10		INTERNAL	
WE RECOMMEND THE FOLLOWING REPAIRS		TOTAL LABOR 220	
TIMING BELT SOON		PARTS 293.9	
		SUBTOTAL 523.9	
		SALES TAX 31.39	
		TOTAL AMOUNT 555.28	
ADDITIONAL COST 2500			
DATE 11:15			
TOTAL 540			

6 SIGN HERE This repair order is a legal document. By signing it, you've committed to having your car repaired at the agreed-upon price. At the same time, signing it protects you. The repair shop can't arbitrarily increase the bill significantly above its estimate without your permission.



7 TOTAL Once the car is completed, the service writer totals up the labor time and multiplies it by the shop's hourly rate, in this case, a modest \$85. The rate varies widely by vehicle (Mercedes = expensive, Chevy = not as expensive) and by zip code (better parts of town might cost more). In some states, you'll pay sales tax on the labor as well as the parts.

8 RECOMMENDED REPAIRS If the mechanic notices something else on your car that needs service, he'll make a note of it here. Any recalls or service bulletins—the first thing he should check for—should be listed here.

9 LABOR CHARGE Most shops charge for labor from a flat-rate book, with predetermined charges for many tasks. The amount of time it takes to replace a starter, for instance, is determined by the time it takes an expert mechanic to perform the operation. A motivated mechanic can often beat this flat-rate time, but you'll still have to pay the predetermined amount. He's expected to do better than book time, at least over the long haul, and his weekly paycheck is determined by the number of hours he books, regardless of how long it takes him. The reverse of this coin is that if the mechanic is having a bad day, or the fasteners are rusty, or for whatever reason the operation takes longer—you still pay only for the book time. In practice, it's a system that's fair for you, the mechanic and the shop. But this is not always the scenario. Some shops keep their mechanics on salary, preferring to bill on some other predetermined basis. Moreover, not all repairs are covered in the flat-rate book. Electrical work—chasing a shorted wire, for example—is usually billed as straight time. In this case, the mechanic simply keeps track of his time on the back of the form.



Tiny Bubbles

Q One tire on my Yukon has a slow leak. Or so I thought, until I just replaced the tire because I got tired of filling it every week. Now the new tire leaks. The guy at the gas station wants to put some of that green, slimy goo in the tire to fix it, but I want him to replace the new tire with one that doesn't leak.



If you see bubbles coming through the metal wheel, mark the area with a grease pencil.

A Did either of you two think that maybe the tire isn't leaking? Most cars have alloy rims nowadays. And unlike steel rims, a fair number of these wheels leak air. It's not a bead-seat surface leak, where air can creep out between the rim and rubber, but a leak through porosities in the cast-aluminum alloy. GM has a published repair procedure for this problem: Inflate the tire to 40 psi or so, and immerse the whole thing in a conventional dunk tank.

Mark the rim with a grease pencil where the bubbles form. Then pull the rim out of the water, and demount the tire from the rim. Scuff lightly with 80-grit sandpaper. Dry off and clean the area corresponding to the leak on the inside of the rim with carb cleaner or mineral spirits, and cover it with a thin layer of silicone gasket sealer. (Don't use silicone tub caulk, which outgases acetic acid as it cures; it will corrode the metal wheel and may damage any tire-

Fender Flare Rehab 101

Someone keyed my Toyota Sequoia on the raised portion of the fender around the wheel. The scratch is about 12 in. long. Can this be repaired or does it need to be replaced?



If yours is flat black, that's the color of the plastic casting. Once scratched, it's virtually impossible to refinish so that the texture matches that at the other three corners of the truck.

Body-colored fender flares can be repainted easily. The technique is a little different than painting metal, but any body shop can do this.

So you have several choices:

Replace the fender flare with a new one. The part should run \$150, or maybe less if you shop or can find a clean one in a salvage lot.

Have all four flares painted at a body shop to match the rest of the truck.

Paint all four flares yourself with some appropriate rattle-can paint. You'll need to sand out and maybe fill the scratch, and use primer or adhesion promoter and a paint intended for plastic, but it's certainly the cheapest option.

pressure monitoring system sender.) Allow it to cure a few hours, then remount and rebalance the tire.

That's GM's take. Other manufacturers have different policies as to what the warranty will do about faulty, leaky rims. I chatted with Matt Edmonds, vice president of Tire Rack, which sells a huge number of tires and alloy wheels. "If we find a wheel that's porous and leaking, we just replace it, not repair it." I'm siding with Matt. Any wheel that has a porous spot large enough to leak air obviously isn't as strong as one that's properly cast. I've had wheels fail structurally at speed, and it's pretty scary.

Pressure Sensitive

I recently had the brake lines replaced on my 1993 Suburban. The original lines had started to rust. Now I notice the brake pedal isn't as firm and full as I like it. Another mechanic checked it over and said the ABS and the master cylinder are working fine. He read me a note from GM that said it is common with Chevrolet trucks and Suburbans. My question is: How do I restore a full brake-pedal feel?

In my book, a spongy pedal after brake work always means improper or inadequate bleeding. I can't find any Technical Service Bulletin (TSB) from Chevrolet that says a low, spongy pedal is normal, although I do think GM pedal feel is generally poor. And we know your pedal was better before the brake lines were changed. The spongy feeling is undoubtedly caused by air trapped in the system somewhere. The brakes and antilock system will check out fine, even though the pedal is squishy. Nonetheless, it's important to get the air out for good brake feel and proper brake bias front-to-rear.

GM says the brake-pressure modulating valve needs to be bled with some special tools, starting with an expensive Tech-1 scan tool. The scan tool is used to cycle the ABS system pumps and solenoid valves during the bleeding process to scour air out of the interior of the valve assembly. There are some internal bleed valves that need to be opened and then reclosed after this procedure. Some ABS systems can be bled manually, or even pressure-bled readily. Others require the use of a

scan tool. There are other tools besides the Tech-1 that will perform this.

One note: There's a GM TSB (93-SE-74) on how to bleed this system properly. Be sure your mechanic has access to this TSB. It says, almost casually, that 2 quarts of brake fluid will probably have to be run through the system to purge the last air. Vehicles without ABS can usually be filled and flushed with a pint or less of fluid. This tells me the job isn't easy or simple. Find a mechanic who has the knowledge and the tools to do this properly.

Lock Lubrication

I have a problem with my manual door locks. When I insert the key I have to jiggle it and turn it at the same time to get the mechanism to unlock or lock. I've used graphite spray made for locks, but it only works for about a week. It does this in any weather. What's the fix?

Start by removing the entire key/tumbler/latch assembly from the door. This probably, but not always, means you'll have to take off the interior door panel. Get out an aerosol can of con-

tact cleaner. (That's contact cleaner for electrical parts, not for contact lenses! You can find it at the auto parts store or even RadioShack.) If you're sure there are no plastic parts in the assembly, you can use carb cleaner—but if there are plastic parts of any sort, avoid using hydrocarbon solvents.

Thoroughly flush the mechanism with the aerosol cleaner, and that includes the tumbler assembly, where the key fits in. I suspect that dirt or corrosion has made one or more of the pins sticky. Avoid any kind of lubricant that leaves a residue; it will trap more dirt or pocket lint. I'd use compressed air to finish the job, but some contact cleaner should be good enough if you're thorough.

The only thing I use for lubricating locks is graphite. I use a graphite-based liquid that evaporates quickly, leaving the slippery, nonthixotropic (nonsticky) graphite powder behind. Or just use powdered graphite—clean the key, dip it in the graphite and work it in and out a half-dozen times. Lather, rinse, repeat.

You can use a sparing amount of grease or Vaseline (I prefer high-temp

THE MECHANIC'S HEADS UP

Working as Designed

HEATING UP HEATED MIRRORS



Heated sideview mirrors are a great convenience. They use a simple resistance heater glued to the back of the mirror glass to gently warm the surface and remove ice and snow, while you keep your fingers warm and dry inside the vehicle. It's a good safety device. I was driving a new pickup last week and noticed an odd thing—the passenger side mirror heated up more slowly than the driver's side. A lot more slowly. So,

as you'd expect, I had to ask why.

Turns out I wasn't the only one who noticed this, because GM has a service bulletin on it, covering a bunch of trucks and passenger cars from the past 10 years or so. There's no problem, they say. The glass on the passenger side is thicker because the mirror is more curved—"Objects in mirror may be closer than they appear," indeed. Thicker glass takes longer to heat up. So complaining to your dealer won't help. And, in truth, the heater isn't supposed to zap all the moisture off the mirror instantly. It's supposed to keep the surface clear while you're driving along, which it does just fine. But if I owned one of these trucks or SUVs, I'd track down a junkyard mirror, dismantle the heater and use it on my own truck. It would be easy to glue it to the back of the mirror right next to the original and wire it in parallel, doubling the heat. — M.A.

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silicone grease—think how hot it gets inside that door on a sunny day) to lube the rest of the mechanism. Reinstall all the parts.

And remember to blow or swipe any lint or dirt off your key before you try to open the door from now on.

Gearing Down

I own a half-ton pickup with an automatic and a V6 engine. I often downshift as I leave the freeway. Would you please comment on this practice?

Sure. I once had the privilege of spending some time with engineer and race driver Mark Donohue, back when I was a race driver and not a journalist. The topic of downshifting came up when another driver said that he would downshift coming into corners to preserve his brakes. Donohue disagreed with this practice: "Brakes are cheaper than engines."

And I have to agree. Don't get me wrong, I downshift both manual and automatic transmissions all the time when the need arises. I do it when I want the transmission to be in the correct gear while exiting the corner, either on the street or the racetrack. On the road, downhills are a good reason to grab a lower gear to keep from building up too much speed and cooking the brakes by riding them.

I know. Modern cars, with low-rolling-resistance tires, low-friction engines, tall gears and superlow drag coefficients, don't slow down as much as they used to. That's part of the reason brake pads have such short lives nowadays.

Bottom line: In spite of Mark's advice to avoid downshifting unnecessarily, downshifting won't hurt

your truck. The automatic transmission won't let you get into a gear that's too low and that would consequently bend the valves. However, you'll have better control on slippery surfaces with your front-heavy pickup when your foot's on the brake pedal. This will make the brakes slow down with all four wheels instead of using the engine to brake just the rear tires. This goes double in rain or snow. Braking the rear wheels too much is guaranteed to cause an instant spin. That's why cars and trucks have bigger, more powerful brakes on the front axle.

Start It Up

How do you start a car with fuel injection? I was told you shouldn't pump the gas. I hear the fuel injection handles this by itself, and you could mess the system up if you pump the gas while you turn the key. Myth or fact?

Fact. Any car with modern fuel injection, certainly any post OBD II vehicle (1996 or later), should be started with your foot off the gas pedal. (Unless there's something wrong, like a leaky injector flooding the engine with raw fuel after shutdown. But that's highly unlikely.)

That leaky injector problem won't occur first thing in the morning, but it could happen after you've run the vehicle awhile and the engine has had a chance to cool off.

In that case, the accelerator should be depressed to the floor to clear the excess fuel until it starts—this signals the computer not to inject any fuel, allowing the plugs to have a chance to dry off. This is called clear flood mode. If the engine cranks for more than 30 seconds or so, turn off the key. Now wait 30 seconds to let the starter cool and depress the accelerator to the floor. Hold it there while you crank for no more than 15 seconds. When the engine starts, be sure to let off on the throttle right away—you don't want to

rev a freshly started engine for long until it gets oil pressure and warms up.

Stop, In the Name of Love

I have a 1993 Chrysler Fifth Avenue with around 120,000 miles. Every time I start the car and press the brake to put the car into drive or reverse, the ABS light comes on for a few seconds and I can hear the ABS pump. Also, the ABS light comes on occasionally when I press hard on the brakes. (When that happens, I also hear the pump.) The brakes are fine otherwise. Any ideas?

Whenever you start a car, the ABS computer performs a power-on self

test. This includes cycling the ABS hydraulic pump and the solenoid valves. In most cars, this isn't done right away, just the first time the brake pedal is depressed. So what you're describing sounds normal.

When you ask enough of the brakes to make one or more tires skid along the ground, the ABS will kick on and prevent the wheels from locking. You'll hear the pump then, too. In fact, you can probably feel it through the brake pedal. That's also normal.

On the other hand, if the car is suddenly acting differently than it did when new, you should have it looked at by a mechanic.

PM

GOT A CAR PROBLEM? Ask Mike about it. Send your questions to pmautoclinic@hearst.com or to Car Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we cannot answer questions individually, problems of general interest will be discussed in the column.



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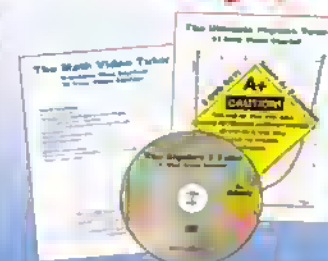
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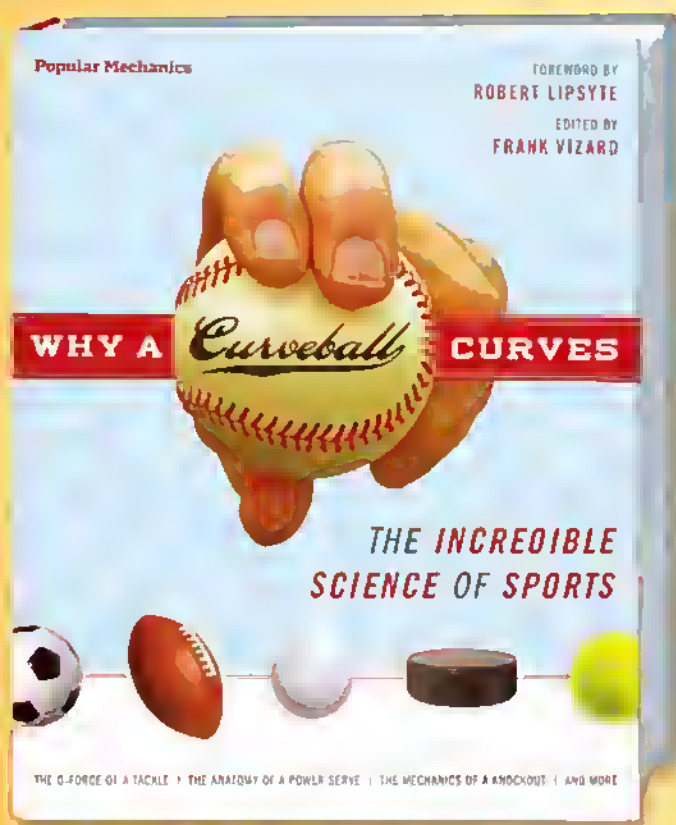
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Networked lighting controls are like a tiny computer in a wall switch. Each one communicates with the others via digital signals over power lines.

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DIY TECH

Smarter Switching

THE FIRST STEP TO HOME AUTOMATION IS TO UPGRADE BASIC SWITCHES AND OUTLETS TO A FULLY NETWORKED ELECTRICAL SYSTEM.
BY GLENN DERENE

"But the light switches work just fine," said my wife. "Why are you changing them?" It was, I admit, a good question. Why go through the trouble to yank out perfectly good light switches and outlets, and then replace them with more expensive, computerized alternatives?

For the time being, networked lighting is still a project reserved for the technologically curious. But I'm willing to pronounce without reservation that if the nascent industry that manufactures this equipment can work out its various standards issues



TOOLS YOU'LL NEED



and bring prices down to earth, this stuff is the future.

Conventional household wiring follows a logic that dates back to George Westinghouse. Each switch must control or pass along current to a load on its circuit. The more elaborate a circuit becomes, the higher the complexity of the electrical handshake at each switch box. If you aren't a licensed electrician, planning and wiring a multiloop, multiswitch branch circuit can involve logistical contortions that will make your cerebral cortex throb.

Networked electrical systems flip a lot of conventional electrical theory on its ear. Each device can communicate with any other device by sending digital signals via either radio frequency (RF) or your home's power lines. Every lighting controller and outlet has its own embedded intelligence and network identity, which means that each one is independently programmable. In fact, networked light "switches" are

not really switches at all, but digital relays or dimmers, in which a digital switch controls the electrical switching. This allows any dimmer or relay in your home to be linked with any other dimmer, relay or networked outlet—they don't need to be on the same branch circuit.

Inside the Wall

Several networking standards are competing right now, and—wouldn't you know it?—they are all incompatible. The big ones are Smartlabs Insteon, Lutron HomeWorks, Z-Wave and Vantage Controls. Lutron and Vantage are aimed at the professional installer market, while Insteon and Z-Wave offer systems that are more scalable, allowing a do-it-yourselfer to start small and expand the system over time.

For my installation I used Insteon equipment. The standard supports both power line and RF. Insteon evolved from an older, more primitive

home automation technology known as X10, and all Insteon controls are backwards-compatible with X10 equipment. These products are still around, but they are mostly chunky plug-in adapters that allow users to turn on or off individual lights and appliances using a keychain remote or a PC. Insteon controls are a bit tougher to install, but they are far more elegant and versatile, because they integrate directly with your household wiring.

While it's not the most expensive of the various home automation products, Insteon equipment is still far pricier than ordinary switches and AC outlets. Expect to pay \$46 for each dimmer, relay or AC outlet.

Most Insteon relays and dimmers look like ordinary rocker switches, albeit with tiny blue LEDs along the left side to indicate lighting intensity. But in addition to simple relays and dimmers, Insteon sells more complex six- and eight-way keypad controllers. These programmable, multibutton affairs allow users to either consolidate many relays into one small controller or create lighting "scenes" (all first-floor lights on/off; driveway, porch and garage lights on/off; etc.) and assign them to individual buttons. Specialized switches like this don't require any additional, complex wiring.

In fact, networked relays have the potential to simplify wiring immensely in new construction, since these systems don't require three- and four-way switches for multiswitch lights (such as hallway lights that can be turned on or off from each end). Each Insteon relay or outlet needs only a hot, neutral and ground wire, and only one relay per circuit needs a connection to the load that is being switched.

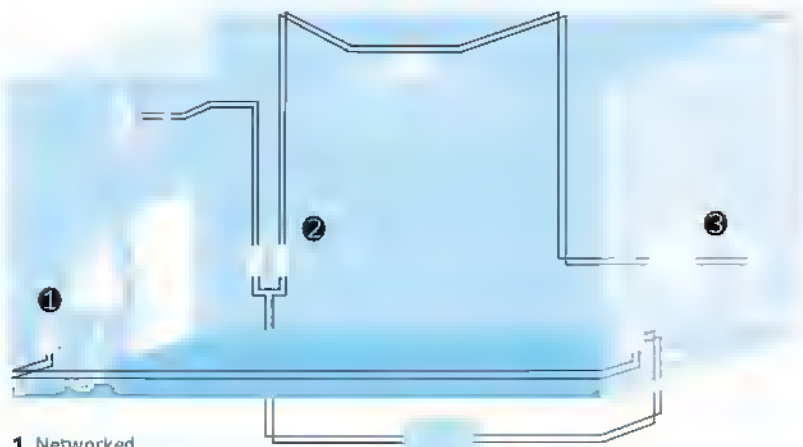
That said, this is not a job for the electrical novice. If you are unfamiliar with how household wiring works, I strongly suggest you hire an electrician to undertake a project like this. Even if you do have a good working knowledge of electrical systems, I recommend you check with the local building-code office before starting a big installation.

In my house, I installed Insteon outlets and relays into existing wiring. Swapping in networked outlets is a simple task of matching the black (hot)



A multibutton networked dimmer allows you to create complex lighting "scenes."

Insteon's dimmers and relays are completely scalable. Because they require no new wiring, you can start by replacing two or three switches, then add more later.



1. Networked wall outlets have one socket that is controlled and one that is always on. Controlled sockets can be linked to remote wall relays.

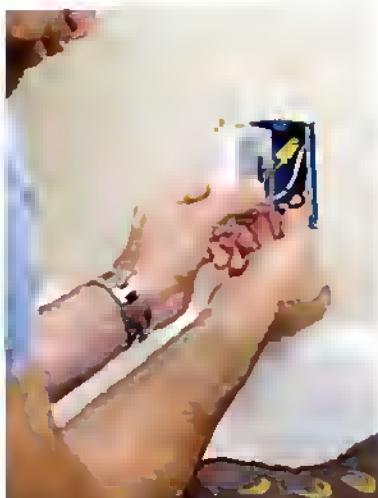
2. With additional equipment, you can set up relays for computer control, creating a digital timer for any light.

3. Remote relays can be digitally linked over power lines without the need for multiway switches or traveler wires.

and white (neutral) pigtail wires that come off the back of the Insteon device with the corresponding wires in your outlet box, then twisting them together with wire connectors. Simple relays and dimmers are slightly more complicated, since unlike conventional single-pole switches, they require a connection to the neutral wire. That's because Insteon relays are electrical devices themselves. Each one is a tiny computer that draws about 7 watts (the new-generation technology that's launching this month is expected to draw 0.7 watts).

It's when you attempt to replace the switches on a multiway circuit with Insteon relays that things start to get really wacky. Unlike conventional three- and four-way switches, Insteon relays don't use traveler wires, so you basically just need to ensure that each box has power. At each box, the Insteon relay needs to be attached to the neutral path, but only one relay on the lighting circuit actually needs to control the load.

If that sounds confusing, just imagine how I felt three days into this project, staring at the eviscerated guts of a



three-gang switch box with a mass of 12 wires dangling lifelessly from it. I had dismantled the branch circuit controlling the lighting for the entire front of my house, and that branch was divided into three separate multiway lighting circuits. My living room, dining room and porch were cloaked in darkness for days as my incredibly patient wife watched me mentally trace my way through the walls, deciphering the logic used by our house's original electrician.

In fact, the most difficult part of my project was figuring out the existing wiring in my house. Insteon controls are easy to understand—all the relays and dimmers have the same four wires. The hard part is figuring out what to attach everything to.

Total Control

Once you've installed everything, you can experiment. In my living room, I have floor lamps plugged into wall outlets and overhead lighting that is controlled by a wall switch, yet these lights are on different branch circuits. The Insteon system let me link the two by depressing the wall relay until it blinked, then pressing and holding a button on the outlet. In 20 seconds, I was able to accomplish what would have taken tons of extra wiring and time to do the old-fashioned way. Also, by installing a six-button controller at the wall, I was able to assign one button to the overhead lights, one to the floor lamps and one to control both. Each outlet can also be set for "load sensing." This lets you override the "off" command of a remote relay and turn a floor lamp on using the lamp's own switch.

I even won my wife over to the system by programming a simple hello/goodbye button at the front door. It turns all the lights in the house on and off from a single button. That's convenient, to be sure, but networked electrical systems can do far more. Because each outlet or relay is a small computer, these devices can be hooked

Networked outlets have a "load sensing" feature, which lets you control plugged devices remotely or locally.

into a house's data network, allowing control through a PC or other connected device. Plus, many of the networked standards

can also link home systems, such as climate control, sprinklers and alarms, into the same computer interface. Everything can be put on a digital timer and even remotely controlled via a cell-phone or computer over the Internet.

Linking networked lighting to an Ethernet network introduces a new level of capability to the system, and it's a project deserving of its own article.

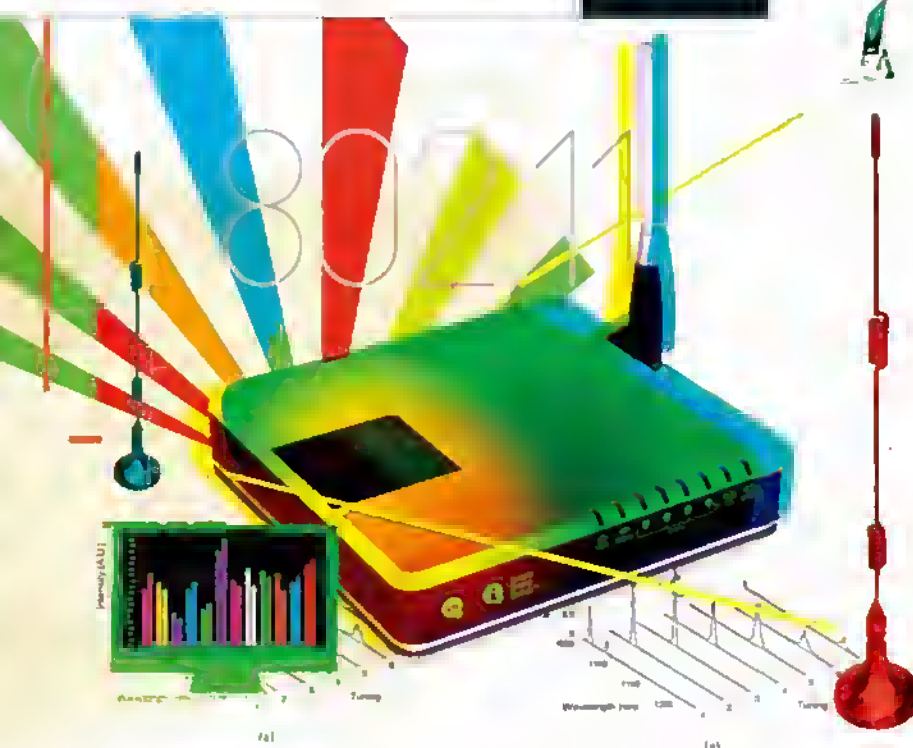
Next month, I'll show you how to expand the system.

PM

Digital Clinic

by Joel Johnson

Q + A



Improving In-Home Wi-Fi

Q The Wi-Fi reception in my house is very weak. Is there any way to boost the signal?

A Wi-Fi can travel through just about anything in your home. If it didn't, it wouldn't be any more useful than a wired Ethernet connection. Still, all those walls and floors—particularly metal frames, brick, drywall and anything with water in it—act like deflector shields for your signal, blocking much of it and ensuring it is weakened by the time it reaches your computer. Other than the obvious step of staying as close to your wireless router as you can—or simply placing it in a central location, with as few intervening walls as possible—there are a number of steps you can take to amp up your in-home Wi-Fi reception.

If your router has a removable antenna, replacing it with a bigger, more powerful one will extend its broadcast range. First, check if your router's manufacturer makes aftermarket antennas (most do). If it doesn't, see what third-party options are available. Just do a Web search for your router manufacturer and the words "Wi-Fi antenna." DIYers can also build their own antennas—the Web is full of detailed plans for this project. If you do choose to make your own, have some fun—any conductive metal will transmit the radio signals, so try making one out of a soup can or retro rabbit ears.

You'll then want to log into your router's firmware to manipulate a few settings that beef up broadcast power. To do this, simply type your router's IP address into

Static Screens

I switched long ago from a CRT to an LCD computer monitor. Do I still need to use a screen saver?

If you leave an unmoving image on a CRT monitor for a long period of time, the screen could suffer from "burn-in," which basically means a ghost of the static image permanently tattoos itself onto the screen, ruining an otherwise fine monitor. How it happens: CRT monitors produce light by energizing phosphor particles with electrons. This generates heat, and if the same image stays on the screen for a long time, the heat can burn the phosphor, resulting in the shadowy burn-in effect. Screen savers "save" CRTs by displaying a constantly moving image.

LCD screens don't suffer from burn-in, but they are susceptible to something known as "image persistence." However, this is not permanent, and can be flushed away by turning the panel off for a few minutes or by playing a video with quickly changing imagery (such as a screen saver).

But even if you don't need one for your LCD, screen savers still serve another important purpose: Leaving a computer idle means leaving it open to prying eyes. Screen savers—and password-protected ones in particular—act as a security shield, preventing snoopers from reading your screen when you step away.

your Web browser's address bar as a URL. The exact address varies by router, but the default for most Linksys and Netgear routers is <http://192.168.1.1>, while most D-Link routers use <http://192.168.0.1>. If neither of these works, just search the Web for your router make and model and the words "default IP address."

This address brings you to your router's control panel, where you will be presented with a number of options. First, look for one called Broadcast Power, or something similar. Not every router will allow you to manipulate this setting, but if yours does, turning it to a higher level will increase the router's power.

Next, try switching your router to another channel. Wi-Fi bandwidth is split into 13 frequencies. If your router is using the same one as a neighbor's, there could be some connection-slowing interference. Because the 13 channels overlap slightly, you really only need to try channels 1, 6 and 11 to see if there is any improvement.

One more fix: There's a good chance your router is running outdated firmware. Updating to the newest version could increase speed and range, and possibly fix some bugs. So check your router manufacturer's Web site to see if there are any available updates.

Lastly, if you are still unhappy with your Wi-Fi reception, you can try replacing your router with a new one that is 802.11N-compliant. These products, which are relatively new to the market, use an advanced form of Wi-Fi that can produce signals capable of traveling up to double the range of the older, more common 802.11G routers. However, in order to take advantage of these routers, your computer needs an 802.11N-compliant Wi-Fi card.

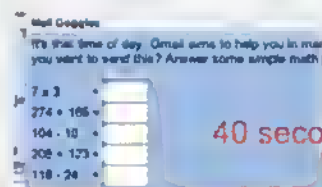
Netflix Delays

My Netflix movies don't seem to be coming as quickly as they did when I first signed up. What's up with that?

You may be the latest victim of the infamous Netflix "throttle." Many Netflix subscribers claim that, after a

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grams that it's easy to lose track of some of them. And while this is always frustrating, most applications and Web sites make it easy to retrieve your password. If you lose it, they typically e-mail you a new one.

With Windows, it's a bit tougher. While reinstalling your operating system will certainly reclaim your computer, this is a nuclear option that could wipe your computer clean of applications and potentially destroy valuable personal files.

That's why you need to look outside the Microsoft ecosystem for help in hacking back into your machine. First step: Find another working computer that has a CD burner, and use it to download a password recovery program. I like the \$50 Active@ Password Changer (password-changer.com), the \$45 Password Windows Key (password.com) and the free

Ophcrack (ophcrack.sourceforge.net). Load up one of these programs and follow the onscreen instructions, which typically involve burning a boot disc that allows access to your computer and resets your password.

Vista also lets you create a password reset disk that can be used if you ever find yourself locked out. To do this, open the Control Panel, select User Accounts, then User Accounts (yes, again), and then click Create a Password Reset Disk. While Windows calls it a reset disk, this file can just as easily be stashed on a thumb drive. Of course, this is something you'll want to do before you lose your password. I suggest you do it as soon as you regain access to your machine, and keep the disk or drive hidden in a safe place—one you won't forget.

PM

brief honeymoon with the DVD-by-mail service, new movies seem to take a bit longer to arrive—particularly for frequent renters. Conspiracy theorists point to the economics behind this: A large portion of Netflix's operating expenses go to paying the post office. So the less frequently you send back your DVDs, the more money the company makes off you.

In fact, this issue was the subject of a class-action lawsuit that was settled in 2008. In the settlement, Netflix admitted no wrongdoing, but amended its terms of service to specify that, in some situations, customers may not receive their top-choice DVD immediately.

These delays can occur in two circumstances. The first primarily affects rural customers. If you live far from a Netflix distribution center, it may take longer than a day for your movie to arrive. Netflix has 55 distribution centers spread throughout the country. The company claims this allows it to provide next-day deliveries to 95 percent of the nation.

More likely, your delay is a result of simple supply and demand. If the number of customers requesting a movie exceeds the company's stock, some people are going to have to wait. When this happens, Netflix looks at how many other high-demand movies (usually new releases) you've rented recently. "If you rent nothing but new releases, it's likely that somebody who rents fewer new releases will get the title first," a Netflix representative told me.

Locked Windows

I lost the password I use to log on to Windows Vista. Do I need to reinstall Windows, or is there another way of regaining access to my computer?

These days, we toss around so many passwords for so many different pro-

HAVE A TECHNOLOGY PROBLEM? Ask us about it. Send your questions to popularmechanics@hearst.com or to Digital Clinic, Popular Mechanics, 300 W. 57th St., New York, NY 10019-5899. While we cannot answer every question individually, problems of general interest will be discussed in the column.

Who's Tracking You (CONTINUED FROM PAGE 71)

teaches cyberspace law at Ohio State University's College of Law. "That means in civil or criminal litigation or a divorce case, you may not know if someone is looking at your files. You have to hope the provider objects."

Because cloud computing is still such a new phenomenon, many of its threats to personal privacy remain unexplored. Seventy percent of consumers use Web-based e-mail services such as Yahoo Mail, Gmail, Microsoft's Hotmail or Apple's MobileMe. The contents of and attachments to these e-mails could be processed or stored on servers around the world. All of these companies state in their terms of use that they must comply with legitimate requests for information from law enforcement, and this is by no means limited to law enforcement in the U.S. That could potentially make the correspondence of a U.S. citizen subject to foreign laws.

Cloud-based social-networking sites such as Facebook and MySpace push the privacy envelope even further, encouraging users to post and share massive amounts of personal data that can be scooped up and stored indefinitely. And in an increasing number of cases, information that people willingly post about themselves online is coming back to haunt them. "The problem is that teenagers, college students and even some adults who ought to know better are not thinking through the long-term consequences of putting up so much personal information," says Daniel Solove, author of *The Future of Reputation: Gossip, Rumor, and Privacy on the Internet*. "Today's reality is that once something is out in the public, it usually stays there."

A Pennsylvania woman is currently embroiled in a lawsuit against Millersville University alleging that the school denied her a teaching degree after viewing a photo on her MySpace page titled "drunken pirate," which shows her sipping from a plastic cup while wearing a

pirate hat. Stacy Snyder was of legal drinking age when she posted the photo, but she claims university officials called the snapshot "unprofessional," and said that it could have offended students at a local high school where she was a student teacher. The university has declined to comment on the case, pending a decision by the judge.

High school seniors and recent college grads have good reason to be nervous if they've posted overly personal data on their social networking pages. According to a survey released in September by education prep provider Kaplan, 10 percent of admissions officers surveyed admitted viewing applicants' MySpace and Facebook pages. Another survey conducted by CareerBuilder found 22 percent of hiring managers used social networking sites to evaluate job applicants, and more than one-third reported finding content that disqualified candidates.

As more personal information is pumped into the cloud, the ability to search through it becomes more sophisticated. That makes digging up intimate details on others even easier. Millions of amateur photographers upload photos to the Web with little regard for the staying power of the medium. In September, Google launched a new version of its Picasa photo-organizing software that uses facial recognition technology to help users identify people in their pictures. Anyone can tag a photo with your name and Google will store that facial fingerprint indefinitely. Picasa's facial recognition will then try to tag any subsequent photos of you it can find.

Another Picasa feature, "geo-tagging" (adding geographical data to shots), allows you to overlay images

"THERE'S A BIG question about which Internet Service Providers are selling what data to whom," says Electronic Frontier Foundation's Kevin Bankston. "The answer is we really don't know."

onto Google maps. While Google has implemented privacy safeguards—users can only tag photos in their own accounts' Web albums—some experts worry that Picasa and other cloud services need to provide consumers with additional protection. "What's to stop a zealous prosecutor from searching the state's digital database of driver's license photos for people under 21 whose online Flickr photos show them engaged in underage drinking?" writes Racanne Young, a program associate at the Center for Democracy & Technology. "What's to stop an employer from doing the same with a photo taken by a video camera in the lobby of the building where you went for your job interview?" Legally, not much. Those photos could show up in court as well. Law enforcement can search even password-protected online accounts without your knowledge, so long as they can obtain a court order.

Richard Stallman, founder and president of the Free Software Foundation, condemns cloud computing and free Web-based services as a trap for consumers. "To use these things is to close your eyes to the question of who these machines are really serving," he says.

None of these technologies ever truly feels like a trap until it's too late—when your embarrassing photos are posted online by your angry ex, when your cellphone data becomes damning evidence against you in court, or when the ads delivered to your e-mail in box become disturbingly personal. And it may turn out that the technological trade-off is unavoidable—to be a part of our digitally connected society requires a redefinition of privacy. The only other option is to unplug completely. **PM**

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When **Chuck Cornelison** gets ready for target practice, he loads his 12-ft-long gun and shoots projectiles in excess of 18,000 mph. But he's not firing ordinary shells: The manager of NASA's Ballistic Range Complex is shooting tiny replicas of meteors and spacecraft from three guns to mimic how craters form and how vehicles may fare in space. The guns were built in 1964 to study re-entry to Earth's atmosphere for the Apollo missions; now they're simulating the space debris that might pummel a moon colony. "We've come full circle," Cornelison says. "There's always something new to try." — **MICHAEL MILSTEIN**

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For each test, Cornelison loads the gun with a projectile and a nylon sabot, which holds the tiny missile in place. Then it's time to shoot: A gunpowder charge initiates the firing, accelerating a piston that compresses hydrogen to 100,000 psi and a tempera-

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2. **High-Pressure Coupling**

A coupling like this one helps make the transition from the larger diameter

pump tube to the smaller diameter gun barrel (3). It directs high-pressure hydrogen into the barrel to propel the projectile.

4. **Vacuum Chamber**

Cornelison fills this airtight container with blends of gases to mimic a planet's atmosphere, or removes

the air to simulate the vacuum of space.

5. **Impact Bucket**

The projectile is shot into a bucket filled with sand or pumice. To simulate an ocean meteor impact, scientists once replaced the bucket with a kiddie pool.

6. **Cameras**

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